TEXILA INTERNATIONAL JOURNAL

TEXILA AMERICAN UNIVERSITY



TEXILA INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH

ISSN : 2520-3088

Volume 8, issue 2

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Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.08.02.Art001

Environmental and Sustainability Literacy among Students at a Selected Institution of Higher Learning in Zimbabwe

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Abstract

The study was carried to assess students' environmental and sustainability literacy at a selected institution of higher learning in Zimbabwe. A descriptive cross-sectional design was used. The questionnaire used was validated, and the Cronbach's alpha was used to determine reliability (α = 0.767). Purposive, stratified and simple random sampling techniques were used to select 70 respondents for the study from a population of 1352. The study revealed that the level of knowledge was mediocre, and one-way ANOVA showed no statistically significant difference in the level of knowledge among the groups (F (3,66) =2.376, p=0.078). Results also showed a positive attitude towards environment and sustainability issues; and identified the need to train every student about environment and sustainability (83%), with government support (93%) to achieve an environmentally sustainable world (96%). It was concluded that although the attitude among students was positive, the current syllabi are not explicit about environmental and sustainability issues which bear negatively on their environmental knowledge. The study recommends the introduction of a compulsory environmental education course in Higher and Tertiary Education in order to raise the environmental and sustainability literacy.

Keywords: *Environmental education, Environmental literacy, Higher and tertiary education, Sustainability literacy, Sustainable development.*

Introduction

Environmental and sustainability literate people are not only aware that their choices have impacts on the environment, but also know that their choices can either help or harm the environment. They also understand that there is a limit to the earth's ability to sustain human and other life. As such, the environmentally and sustainability literate people are motivated and empowered to keep the environment healthy and be able to meet current and future generations' resource needs. The opposite is also true for environmentally illiterate citizens: they pollute the environment and are not concerned about the impact their choices have on the environment. Environmental literacy is a branch within the field of environmental education concerned with the "awareness of, and concern about, the environment and its associated problems as well as knowledge, skills and motivations to work towards solutions of current problems and the prevention of new ones" (UNESCO, and North American Association for Environmental Education (NAAEE), [1]. The term was first used in the 1960s by Roth who inquired "How shall we know the environmentally literate citizens?" This was in response to media reports referring to those who were polluting the environment as "environmentally illiterate" [2].

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Recognizing the need for environmental and sustainability literate citizens, the field of environmental education emerged. Environmental education is seen as a process of infusing into the educational system's environmental content in order to enhance the awareness of the people on environmental issues at all levels of education [3]. It is concerned with knowledge, values, attitudes, skills, application and it aims at environmental responsible behaviour. In 1978 UNESCO,[2] put forward the 1977 Tbilisi Declaration's three basic goals of environmental education as: (1) to foster a clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas; (2) to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment; (3) to create new patterns of behaviour of individuals, groups and society as a whole towards the environment. Consequently, the concept and aim of environmental education has evolved and has been modified to emphasize environmental education for sustainable development with the expectations of cultivating environmental and sustainability literacy among citizens in order to promote environmentally sustainable societies throughout the world.

Environmental education is ideal for the achievement of sustainable development. Sustainable development is that type of development that meets the needs of the present generation without compromising future generations meeting their own needs [4, 5]. The concept of sustainable development emerged in the 1970s, and it gained more attention in 1987 after the publication of the Brundtland report *"Our Common Future"* by the World Commission on Environment and Development. Ever since, the concept of sustainable development has been widely discussed as seen by the several local and international initiatives such as the International Union for Conservation of Nature (IUCN), Tbilisi Declaration, International Environmental Education Program (IEEP), the United Nations Conference on Environment and Development, the Earth Summit, Agenda 21, the 2002 World Summit on Sustainable Development, Decade of Education for Sustainable Development (DESD: 2005-2014), Millennium Development Goals (MDGs) and the 2030 Agenda for Sustainable Development (17 sustainable development goals (SDGs)). At the heart of every approach to sustainable development, is education and learning. The DESD (2005-2014) aimed at integrating the principles and practices of sustainable development into all aspects of education and learning, to encourage changes in knowledge, values and attitudes with the vision of enabling a more sustainable and just society for all, [6]. In the 2030 Agenda for Sustainable development numerous education-related targets and indicators are contained within other SDGs on top of the SDG number 4 on quality education: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [5].

While several philosophies have informed and shaped environmental education, various published environmental sustainability frameworks, [7] have reflected the UNESCO's 1978 objectives which include awareness, knowledge, skills, attitudes and participation, [8]. Building on this information, this research was based on the premise that knowledge (behavioural beliefs, normative beliefs, control beliefs) affect dispositions (attitudes, subjective norms) and competencies (perceived behaviour control) which ultimately affect behaviour intention, and finally pro-environmental behaviour, [9]. While the simplest forms of environmental knowledge are learnt at home (indigenous knowledge systems), Higher and Tertiary Education (HTE) provide learning opportunities for more complex environmental issues. Environmental education in such institutions of higher learning establishes a knowledge base upon which individuals can make environmentally sustainable decisions and build an environmentally sound future.

Environmental and sustainability assessment then, therefore, provides a baseline of the knowledge, abilities, dispositions and behaviour of students that futuristically enable them to make environmentally informed decisions and act to address environmental issues. It is against such a background that this research was undertaken to assess students' environmental and sustainability literacy level at a selected institution of higher learning in Zimbabwe.

Statement of the Problem

Despite the fact that environmental education is now widespread in Zimbabwe, environmental challenges are on the increase. Recognition of increasing challenges associated with environmental management and sustainable development has implications for, and linkages with, environmental education in institutions of higher learning. As tertiary education students are expected to be the torch-bearers in the alleviation of these challenges through their envisaged acquired skills and knowledge, [9]. Little is known about the environmental and sustainability awareness, knowledge, attitudes and cognitive skills of students. Environmental literacy assessments are therefore principal sources of information about the status of environmental and sustainability literacy in higher and tertiary education institutions, [10]. These assessments also assist to determine the extent to which different environmental education programs and approaches have on students' environmental and sustainability literacy. It is against this background that the research on environmental and sustainability literacy was undertaken to assess the students' environmental and sustainability literacy level, and if such gained knowledge is translatable into environmentally responsible behaviour.

Purpose and Research Objectives

The research intended to measure environmental and sustainability literacy among students at a selected institution of higher learning; and therefore, the following objectives were addressed:

i. To examine environmental and sustainability literacy level among higher and tertiary education students in Zimbabwe.
ii. To assess students' attitude towards environmental and sustainability issues.
iii. To ascertain the relationship between fields of study and literacy level on environmental and sustainability concepts.

The third objective was ascertained using the null hypothesis that: "There is no significant difference in the level of knowledge of environmental and sustainability concepts between fields of study" (divisions).

Methodology

Research Design

The main aim of the study was to measure environmental and sustainability literacy levels among students at a selected institution of higher learning. A descriptive cross-sectional design was used in this research to generate both qualitative and quantitative data. The study design provides a snapshot of students' level of environmental and sustainability literacy at a point in time. It also describes the situation as it is on the ground so that plans for change can be designed if the picture portrayed by the study is not desirable; and can also be a basis for more in-depth studies.

Population and Sample

The population in this study included four groups of students and key informants. Students were selected from the following four fields of study areas (divisions): applied sciences, engineering, applied arts and commerce (N = 1352). These fields of study (divisions) were used to stratify the population. Four key informants from the four fields of study were selected using a purposive sampling strategy. Using fields of study as strata, simple random sampling technique was used to select

participants from the student population giving rise to 70 (5.2%) respondents who participated in this study. A sampling rate of over 5% in social science research is considered a large enough sample, [11]. This sample excluded students in their first year of study.

The researcher sought and was given permission to undertake the research; and informed consent by respondents was also sought and anonymity was ensured. Data collected was only used for the purpose of this research. After data was collected, it was analysed using descriptive statistics. First, it was cleaned, coded and later it was entered into IBM SPSS statistics 20 in order to analyze environmental and sustainability literacy levels among students at a selected institution of higher learning.

Data Collection and Analysis

A questionnaire checklist was used for students to obtain relevant information for this study. The questionnaire was divided into three sections. The first section (Section A) included statements about students' attitudes on environmental issues and processes. Each statement was measured on a 5-point Likert scale (strongly disagree–strongly agree). The second section (Section B) included statements about students' behaviour towards environmental issues and processes. Each statement had three possible responses (Frequently do it/ sometimes/ never). The third section (Section C) included statements on students' knowledge of environmental issues and processes. Each statement had five options.

A pool of 38 statements that belonged to these three sections was generated. The questionnaire was validated (by undertaking a pilot testing) and the Cronbach's alpha was employed to determine reliability. Initially, it yielded an alpha co-efficient of 0.735. Five statements "with a negative Corrected item-total correlation" were later deleted, resulting in Cronbach's alpha = 0.767 (Cronbach's alpha "if item deleted"). As a result, the final questionnaire had a pool of 33 statements, upon which data analysis was based. Cronbach's alpha ranges from $\alpha = 0$ to 1, with $\alpha = 0.7$ or greater taken to be sufficiently reliable, [12].

Data obtained from the questionnaires were triangulated with data from key-informant interviews and document review. Key informant interviews largely asked about their views on environmental and sustainability literacy, as well as how environmental and sustainability is taught in their fields of study; while syllabi in the four study fields were reviewed to perceive inclusion of sustainability concepts.

The raw data from responses of each participant were coded numerically. For section A, the responses were converted to 0 and 1, for "disagree" and "agree", respectively. For section B, the responses were converted to 0 and 1, for "never do it" and "do it", respectively. For section C, the responses were converted to 0 and 1, for incorrect and correct answers, respectively ("don't know" responses were coded as incorrect). Data were entered and analyzed using IBM SPSS statistics 20. One-way ANOVA was employed to determine if a statistically significant difference exists between the group means and the Least Significant Difference (LSD) post hoc test was also used to determine where the real statistically significant difference exist among the groups.

Results and Discussion

All the 70 questionnaires distributed to respondents were returned (100%). These questionnaires were assessed for completeness of responses, and all were valid for analysis and presentation. Below, figure 1, shows the distribution of participants per division/ strata.

The engineering division contributed the highest proportionate sample (37.1%) and applied arts contributed to the least proportionate sample (8.6%).

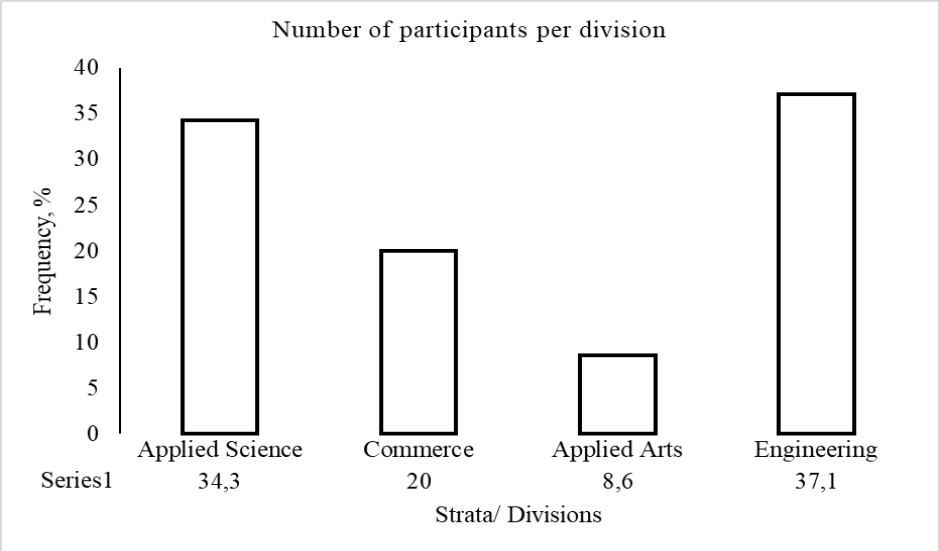

Figure 1. Data on Number of Participants per Division/ Strata

Table 1a. Knowledge on Environmental and Sustainability Concepts

Statement	**Mean**	**Std. Deviation**
Renewable resource	.69	.468
Type of hazardous waste	.27	.448
Term describing diversity of living things	.26	.440
Electricity generation in Zimbabwe	.97	.168
Sustainability refers to	.51	.503
Definition of sustainable development	.26	.440
Causes of climate change	.54	.502

Respondents' Knowledge on Environmental and Sustainability Concepts

The following tables, table 1a and 1b show the level of knowledge possessed by respondents in the various divisions.

Less than 50% of the participants got statements 2, 3 and 6 correct: types of hazardous waste (27%), a term used to describe a diversity of living things (26%) and definition of sustainable development (26%). Almost half number of participants correctly defined sustainability (51%). On average, students failed to articulate essential concepts of the environment such as important cause-effect relationships or even the basic environmental concepts such as types of hazardous waste, definition of biodiversity, sustainability or sustainable development, or the causes of climate change.

Table 1b. Summary Data on Level of Knowledge on Environmental and Sustainability Concepts

Descriptive Statistics			
Strata/ Division	**N**	**Mean**	**Std. Deviation**
Applied Sciences	24	3.42	1.56
Commerce	14	3.07	1.21
Applied Arts	06	2.67	1.21
Engineering	26	4.00	1.30
Total Score	70	3.50	1.412

Applied arts division had the lowest mean-score of level of knowledge (2.67) and the Engineering division had the highest mean-score (4.00). Students who took an environment-related subject or topic were more aware of environmental and sustainability concepts compared to students without (Table 1b). However, about 51.4% of the respondents got scores greater than 3.5 (average mark). This shows that the level of knowledge pertaining to environmental and sustainability concepts is low. This low knowledge levels are in direct contrast with programs and strategies implemented at the institution aimed at instilling environmental responsible behavior. These strategies include existence of an institutional environmental management policy and planned awareness and clean-up campaigns. However, such strategies should be coupled with enabling curricula, but the current syllabi are not explicit about environmental and sustainability issues. While some syllabi are silent about environmental and sustainability literacy, others are inclined towards industrial safety and/or waste management; for example, the following are extracts from the sampled syllabi:

1. *"The aim of the subject is to develop with the knowledge, skills and attitudes to promote sustainable environmental health"*
2. *"The aim of the subject is to develop with the knowledge, skills and attitudes of environmental pollution and control and industrial safety"*

Besides such aims, the contents of such syllabi do not articulate or point to ways or means of contributing to sustainable development. This leaves the mandate to individual lecturers who may or may not link topics to sustainable development. [13] said that it is a critical need of society for HTE to develop graduates who help implement a paradigm of sustainability, yet often times educational curricula do not adequately address this need. With the current curricula, most of those students who graduate are environmentally and sustainability illiterate. The same was also echoed by [14] who noted that unless students were majoring in biology or environmental studies, they could complete their studies without gaining basic environmental literacy. On the other hand, [15] asked the question *"Isn't it time that sustainability concepts such as environmental literacy and social responsibility/ civic engagement become an integral part of all higher education degrees?"* With the state of our current environment and our current higher education curricula, it is at that time that sustainability concepts be an integral part of higher education. [16] echoed the same sentiments when he said that the whole education process should be "reshaped" for sustainable development.

The findings also showed that there was a no significant difference in level of knowledge on environmental and sustainability concepts between divisions as shown in table 2a.

Table 2a. Results of One-way Analysis of Variance (ANOVA)

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Total Score * Division	Between Groups	(Combined)	13.405	3	4.468	2.376	.078
	Within Groups		124.095	66	1.880		
	Total		137.500	69			

There was no statistically significant difference in knowledge between groups as determined by one-way ANOVA ($F(3, 66) = 2.376$, $p = 0.078$). This finding was in contrast with the findings of [17, 18] who found a significant increase in environmentally responsible behaviour among students who were exposed to environmental literacy concepts compared to those students without; and the former were more willing to take actions to make

a positive difference. Although such a single subject may be enough to change some unsustainable attitudes and behaviours, they may not be enough to help the students to understand, internalize and contribute to the intricate sustainable concept in the long-term.

However, the Least Significant Difference (LSD) post hoc test revealed that there was a statistically significant difference between engineering and commerce divisions ($p = 0.045$) and between engineering and applied arts division ($p = 0.035$); as shown in table 2b below.

Table 2b. Results of the Least Significant Difference Post Hoc test

Multiple Comparisons						
Dependent Variable: Total Score						
LSD						
(I) Division	(J) Division	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	.345	.461	.457	-.58	1.27
	3	.750	.626	.235	-.50	2.00
	4	-.583	.388	.138	-1.36	.19
2	1	-.345	.461	.457	-1.27	.58
	3	.405	.669	.547	-.93	1.74
	4	**-.929***	.455	.045	-1.84	-.02
3	1	-.750	.626	.235	-2.00	.50
	2	-.405	.669	.547	-1.74	.93
	4	**-1.333***	.621	.035	-2.57	-.09
4	1	.583	.388	.138	-.19	1.36
	2	**.929***	.455	.045	.02	1.84
	3	**1.333***	.621	.035	.09	2.57

The mean difference is significant at the 0.05 level

Students' Attitudes on Environment and Sustainability

The figure 2 below shows data on the attitudes of students on environment and sustainability issues. Most statements had their mean-scores higher than criterion mean of 0.5 (which served as a benchmark) signifying a positive attitude on the environment and sustainability among students. Positive environmental responsible behavior attitude is determined with responsible environmental behavior. [8] stated that:

"based on the theory of reasoned action, when pro-environmental behavior of students is positive (attitudes) this would result in greater intention (motivation) and students would most probably exhibit pro-environmental behavior."

Statements on *Industries should continue to pollute the environment as long as they pay* and *There is no point for students to get involved in environmental management since the government and industries have the power to do what they want* had mean-scores of 0.014 and 0.043, respectively. These statements were negatively constructed, and hence ultimately signify a positive students' environmental attitude. However, of note are statements on *our school is environmentally clean* (0.514) and *our nation is environmentally healthy* (0.257). This negative attitude on the state of our country's environment signifies that what is learnt or practiced in these institutions is not easily translatable into environmental responsible behavior when one completes his or her higher education.

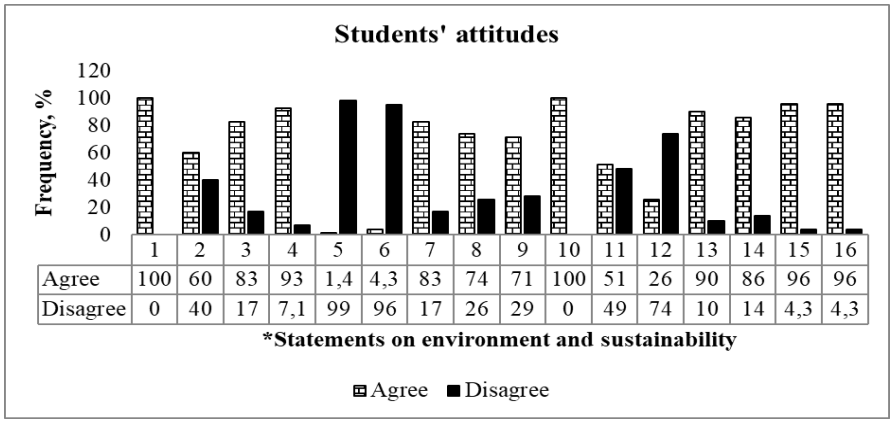

Figure 2. Data on Students' Attitudes on Environment and Sustainability Issues

Key: Statements on Attitudes about Environment and Sustainability Concepts

1. Unpolluted learning environment is a right.
2. Technology will find solutions for environmental problems.
3. HTE should to train all students in EE/ SD
4. Government should support EE/SD in HTE
5. Industries should continue polluting
6. Students should not participate in environmental management
7. Involvement in clean-up programs has had positive impact
8. Government to pass waste recycling mandatory laws
9. Interested in working to protect the environment
10. Nation becomes socially, economically, environmentally well-developed
11. School is environmentally healthy
12. Nation is environmentally healthy
13. I am part of the community to solve environmental problems
14. Develop community to be environmentally sustainable
15. To lead a sustainable lifestyle
16. To live in an environmentally sustainable world

It is also interesting to note that despite the course being studied, respondents echoed that every student should be trained in environmental education for sustainable (0.829) with government supporting environmental and sustainability education in higher and tertiary education institutions (0.929). This will ensure realization of an environmentally sustainable world (0.957). As beneficiaries of the future, students need to have knowledge of environmental problems and how to participate in creating an environmentally sustainable world. The difference between a sustainable and a chaotic future is learning, [19, 20]. It is, therefore, important that HTE produce not only critical thinkers but also environmentally responsible citizens. [21] noted that an education system needs to foster a sense of connectedness, and ecological citizenship, and provide the competence to act on such knowledge. Such students will, after they graduate, get engaged in creating sustainable environmental solutions.

Statements 5 and 6 (above) were asked in a negative way and were rated low (1.4 and 4.3, respectively). Ultimately, respondents identified the need for industries to stop their unsustainable polluting trends and adopt cleaner production systems. Respondents also realized that their roles as students in sustainable environmental management were crucial.

Responses from Key Informants

Four key informants were purposively selected for the study. They were interviewed basically about their views on environmental and sustainability literacy as well as how environmental and sustainability is taught in their areas of specialty.

Key informants had varied views on sustainability literacy. Responses on their basic

definition of sustainability ranged from *"meeting human needs", "placing humans at the centre of everything" to "trying to conserve the environment for the future."* These views placed much emphasis on the social and economic pillars without giving much regard to the environment pillar of sustainable development. The views or frame of mind of key informants determine environmental behavior in learning institutions. [22] said that it is crucial to determine the frame of mind on sustainability of trainers as this enables cultivation of sustainability in learning institutions as a culture.

When asked about how environmental and sustainability concepts are taught, the general outcome was that the current curricula do not clearly outline sustainability issues. One key informant stated that *"it is scant as sustainable development is only mentioned in the objectives section of the syllabus. It rests upon me to infuse sustainability concepts in the topics I teach."* Where concepts of sustainable development are not clearly articulated in the syllabi, there won't be any instrument to measure whether such concept have been infused in topics taught, or to what extent have they been infused [5, 23] pointed out that environmental education (environmental and sustainability) should be conceptualized as an integral facet of education so as to give impetus to sustainable development.

Conclusion

The level of literacy on environmental and sustainability issues among students at the institution studied was low. The low literacy level may be attributed to the curricula not being explicit about environment and sustainability issues. This low literacy level is not ideal for the attainment of a sustainable world.

The literacy level among the four fields of study was not statistically different, although the engineering division had the highest mean-score while applied arts division had the lowest mean-score.

However, the students showed a positive attitude on the environment and sustainability issues. This positive attitude needs to be coupled with high level of knowledge on environment and sustainability concepts in order to achieve the goals of sustainable development.

Recommendations

In light of the findings of this study, the following recommendations were made:

- Low knowledge levels among students signify that a compulsory generic course, such as Environmental Education for Sustainable Development (EESD), is needed in Higher and Tertiary Education. This can be introduced as an additional subject or be infused into the existing curriculum subjects.
- An updated curriculum for tertiary education should be introduced, which makes explicit environmental and sustainability literacy. This will further call for capacitating such institutions and their human resource to prepare them to teach EESD.
- Proven, flexible, inexpensive and fun approaches to teaching EESD should be used so that gained knowledge can easily be translated into environmental responsible behaviour for sustainable world.

Suggestion for Further Research

This study focused on one selected institution of higher learning in Zimbabwe. As such, more comprehensive studies on environmental and sustainability literacy in higher and tertiary education institutions in Zimbabwe are recommended. Results from such studies are more generalisable and possess greater eternal validity.

Conflict of Interest Statement

The authors Taremba Chirigo, Joe Phaeton Mukaro and Fenton Ruparanganda declare that there is no conflict of interest.

Acknowledgements

Authors would want to acknowledge the Ministry of Higher and Tertiary Education of Zimbabwe for allowing the authors access to students and college facilities.

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Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.08.02.Art002

The Impact of Employee Engagement on Organization's Productivity on United Methods on Relief Services

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Abstract

Employee engagement has arisen as a widespread organizational perception in current years. It is the level of strength of mental and emotional connection employees feel toward their workplaces and its values and beliefs. When employees are engaged and aware of the business framework and work as a team to improve performance within the job for the advantage of the organization. Employee engagement resourcefulness has a straight effect on the organization's level of production. Every company/ organization requires their workers to be engaged in their respective work. Employee engagement is linked to customer satisfaction which is connected to an organization's financial success. Engagement arises when adequate individuals give attention to performing good work and care concerned about what the company is thriving to attain and in what way it is an accomplishment. This helpful mentality and behavior only arise once people get satisfied with their jobs they do and are convinced that the organization supports them, with an effective HR manager. This paper covers a literature review from several study findings and practices employed by the use of an expressive research method. It schemes the effect of worker's engagement on the productivity of the organization. It also showcased the factors affecting the worker's assignation and organizational results.

Keywords: *Employee Engagement, Organization, outcome, Productivity, Retention.*

Introduction

Over the past years, many writers have written on the topic 'Employee engagement. Employee engagement is referred to a result of how staff take their work, the leadership of the management of the organizations, the rewards and recognition they get, and the communication style of the organization [1]. It is arguably the most critical metric for organizations in the 21st Century. Employee engagement is rightly impacted by the progress of the organization's value added practiced by personnel and personnel perception of theorganization. Human Resource experts believe that the engagement has more to do with how the employees feel about their job experience and how they are treated in the organization. It has more to do with sentiments which are basically linked to drive bottom line accomplishment in an organization. Employee engagement inventiveness has a direct effect on the organization's level of production. The idea of engagement has logically progressed from past studies on high empowerment, involvement, motivation, trust, and organizational commitment.

The key factors in engagement are as alignment of employees toward strategy, enabling employees to have the capability to engage themselves; and creating a sense of engagement. The many-sided nature of workers engagement is fit taken by the Employee engagement Association at United Methods on Relief Services. The researchers say that: 'fundamental to the concept of employee engagement is the idea that all employees can contribute to the successful functioning and continuous improvement of organizational processes. All in all, employee engagement is

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about generating prospects for personnel to link with their managers, colleagues, and the broader organization. It is about creating an environment where employees are motivated to connect with their work and care about doing a good job'.

Materials and Methods

The population of the study consists of employees and managers of the United Methodist Committee on Relief organization. They are in full-time employment. The rationale behind the selection of this sample is the high exposure of the respondent at a managerial level. Since the staff may be viewed as the drivers of the organization and the country's economy, their perceptions may be deemed very influential and informed due to their strong work experience and educational background.

Questionnaire Development

A questionnaire was developed from the literature study and selected employees to indicate the importance of the 10 employee engagement constructs by answering 15 measuring criteria in relation to employee engagement in the Organization. The questionnaire employed a 5-point Likert scale to show the insights of the respondents' employee engagement. Although the 10 constructs depict specific employee engagement components, the synergetic effect provides a coherent picture for data collection when they are interpreted together.

Data Collection

The data collected for this study was through a survey, which is the technique of gathering data by asking a set of articulated questions in a programmed order in an organized survey form to illustrate individuals drawn so as to be representative of a defined population [2]. A total of 15 questionnaires were administered independently by this study to respondents for completion. In the bid to guarantee high response frequency, interviewees could finish the survey forms at the start of the meeting, where the researchers enlightened them on the importance of the study to wait beforehand for survey forms to be finalized. A total of 15 questionnaires were completed and 3 questionnaires were incomplete resulting in a non-response of 3 questionnaires. This gives rise to a total rate of response of 86.6%.

Data Analysis

The Statistical Package for the Social Sciences Incorporated (SPSS) Version 22 was used to analyze the data statistically. Similar research in the past successfully employed the following statistical procedures and decision criteria [3].

C Exploratory Factor Analysis (EFA)

Because of its experimental nature, loading factors of 0.4 and more were measured to confirm the stuff that quantify each of the personnel achievement effects [4] (Objective 3). C The Kaiser- Meyer-Olkin (KMO) measure of sampling adequacy was utilized to ensure that the sample used is adequate. Various authors have proposed that a KMO rate of 0.6 ought to be the least suitable rate if experimental factor analysis is taken into consideration. These values are observed to be average, while additional satisfactory rates are between 0.7 and 0.8. rates between 0.8 and 0.9 are very promising values above 0.9 are superb) (Objective 4). This study followed advice from the literature and set a maximum value of 0.005 [4]. Data lower than 0.005 portrayed that the figures are suitable for multivariate statistical analysis, therefore, exploratory factor analysis (Objective 5). C the variance clarified by the factor analysis aids as an indicator to control the importance of each of the constructs to measure employee engagement (Objective 6). A variance of 60% and higher is a good fit to the data. This study aimed to achieve a good fit for the data, aiming to achieve 60% of variance per factor. Satisfactory reliability coefficients exceed 0.70. Secondary lower consistency coefficient was set at 0.58. As highlighted by some authors, such as Cortina, that when ratio and interval scales are used (such

as the Likert scale used in this questionnaire), it does permit a lower reliability coefficient (Objective 7) [5].

Statistical Validation

Each employee engagement construct was authorized by calculating the KMO values, Bartlett's tests of sphericity, the variance clarified by the specific construct in the factor investigation, and the exact construct reliability. Furthermore, determining standards by a factor of loadings below 0.40 were left out from the analysis, while robust double loading standards were also left out due to their double nature [4, 6]. This technique also measures the criteria loads as one factor, meaning that the measures are a specific construct. In the situation where many factors are identified, the sub-factors are recognized and branded as separate sub-factors of the exact employee engagement construct.

Results

Results of the Reliability Assessment

As stated earlier, the reliability assessment for the entire survey was 0.83. Results of the reliability assessment for the entire survey instrument indicated that the Cronbach's alpha for each section of the questionnaire was between 0.78 and 0.85. Therefore, the four segments of the study are all higher than the 0.70 required to establish reliability and are at an acceptable level of reliability [7]. Results for the 15 specific questions to the research question are shown in Table 1. Once again, the results are all greater than 0.84, with the engagement section being 0.71, the communication section 0.81, the leadership section 0.71, and the Loyalty section being 0.80.

Table 1. Reliability Assessment

Type	Number of Items	Alpha
Employee engagement	5	0.84
Communication	5	0.81
loyalty	5	0.80
leadership	5	0.71

Descriptive Statistics

A total of 10 questions were asked of the respondents regarding various factors that contribute to their level of engagement to the organization. The questions were divided into four sectors through the design procedure of the survey tool and they include; Employee engagement, Loyalty, Communication and Leadership. All but one category of responses was organized on a 5-point Likert scale (1-strongly disagree, 2-disagree, 3-Neither disagree nor agree, 4-agree, 5-strongly agree). Demographics were compiled to show means, standard deviations, and frequencies for each.

The respondents ranked "Employee Engagement" as the highest section related to their level of engagement (M = 3.87). Interesting to note, within the top-ranking section of "Engagement of Employees", the number one ranking item was specifically related to those who have the materials and equipment they need to do their work (M = 4.1, SD-0.84). The Communication" section ranked second in the results with a mean of 3.81, while "Loyalty" with a mean of 3.80. Finally, the lowest ranking item in the lowest-ranked section of "Leadership" with a mean of 3.71 was the question. My manager keeps me up to date on meeting my objective or goal and is the least scoring factor (M= 3.69; SD = 0.84). By examining the preliminary outcomes, it is apparent that Engagement of workers and communication does have a substantial influence on Employee Engagement [8].

Employee Engagement is the emotional and intellectual involvement and commitment by personnel to the organization. The personnel actions are quantifiable at the work group level and not at the distinct level. Several scholars such as Rothbard believe that engagement is an important factor in business performance influenced by how the business is conducted [9]. Critical components include the role of leadership, the culture and ecosystem in the organization created through the policies, processes, communication mechanisms, and overall business practices. They believe that engagement prompts an employee to focus on the organizations' success and how he/she can best contribute to that success. They enjoy what they do and feeling valued for doing it.

Communication and Employee Engagement

It has been asserted that communication is a very significant variable in conveying a larger organizational effectiveness [10]. Similarly, other scholars also agreed with the significance of communication and the effect of management's communication on performance [11]. Intuitively, this only makes sense as one needs to have access to information, knowledge and training to meet expectations and performance objectives. The initial research findings from this study further support these theories with leadership, communication and employee loyalty having at least a 0.70 correlation to engagement. The engagement has been defined as consisting of relationships and process of communication that engage the employees while suggesting many researchers have overlooked the relationship between communication as a dimension of engagement [1].

Furthermore, the findings support previous work on organizational commitment in one's desire to continue within an organization due to psychological affection [12].

Leadership and Employee Engagement

Ten leadership qualities essential to employee engagement had been identified, and intent to stay with communicating effectively being ranked third and developing talent and coaching employees as sixth [13]. These results would support Kahn's management style theory and provide feedback and development opportunities being related to one's level of engagement [14]. This was also confirmed with managers' communication being ranked number one in the work activities construct, which was the highest-ranking component of the overall engagement.

One previous study revealed primarily that direct communication between the senior leadership and employees is strongly related to employee commitment and engagement [15]. More recent business trends suggest that employees want their leaders to be open and honest about the company details. They expect their leaders to be mentors and give them feedback. They also need leadership to motivate, encourage and generate a desire for the work, including face to face communication about the company's objectives, growth, and impact [13, 16, 17].

In the present study, leadership's communication and engagement correlation was 0.78, indicating a strong relationship between the two. The four key areas of effective leadership communication had been identified as purpose clarity, effective interfaces, information sharing, and communication behaviour [18]. In comparing the communication items of the study to these four areas, the factor analysis results further substantiated the importance of effective leadership communication relative to engagement. This includes the need to provide clear direction and information about business goals and objectives. The role of communication by management and senior leadership is also significant regarding one's level of commitment

to the organization, with the role of the immediate manager being critical to building overall engagement. This research study also supports strong co-relation of leadership and employee engagement where employees appreciate their managers keep them informed about how well each employee meeting their goals/objectives (Mean-3.79); Giving them useful feedback on their performance (Mean-3.94); provide them clear direction for the future of the organization and their function (Mean-3.72).

Discussion

This study demonstrates that employee engagement has a major impact on both, staff performance and overall organization performance. This influence is positive and critical in a sense the organization's productivity will go very high while the employees are happy to deliver results. This answers the research question, which states that "what is the impact of employee engagement on an organization's productivity?" This finding is surprising considering the ubiquitous nature of employee-manager's relationships stemming from concerns about the deteriorating quality of productivity in some companies across the whole world. At present, the personnel's engagement, had been defined positive performance attitude, which can amount in an improved level of activation and identification with the organization's goals- leading to a positive effect on the employee's work determination, is measured as one of the main questions concerning the work of all organizations which is not for in developed economies alone [20]. Employee engagement in this context is about how we create the conditions in which employees offer more of their capabilities and potential. Indeed, most managers had a general understanding that the most significant impact that their businesses have on the employee's engagement.

Finding from this study have several practical implications that have relevance to both organizations and employees. It implies that for sustainable business practices to become more common across the business world, which is the biggest polluter nationally and globally, employees must be involved in all affairs of the organization to and not be allowed to feel left out. The positive association between the two variables means the more we have of the independent variable–employee engagement, the more we will have of the dependent variable–loyalty.

Figures and Tables

Correlation analysis of employee engagement and manager's perception produced a Person's correlation coefficient of 0.811 and a significance of 0.000 at 0.01 confidence level, indicating that there was a positive and significant correlation between the two variables that deserved further investigation (Table 2).

Table 2. Correlation Analysis Results

Correlations		
Environmental education		**Sustainable business practices**
	Pearson Correlation	.811**
	Sig. (2-tailed)	.000
	N	40

** Correlation is significant at the 0.01 level (2-tailed).

A model summary indicating r values showed that employee engagement is a strong predictor of organizational practices at 65.8%, meaning that if a manager has engaged employees at all levels in the organizations business, they are 65.8% likely to be motivated practices (Table 3).

Table 3. Model Summary Results

Model Summary			
Model	**R**	**R Square**	**Adjusted R Square**
1	.811	.658	.643
a. Predictors: (Constant), Planning			

A regression coefficient analysis yielded significant p values of less than 0.05 significance level, enabling the formulation of a regression equation indicated in table 4.

Table 4. Coefficient Analysis Table

Coefficients					
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	Beta		
(Constant)	.832	.319		2.243	.023
Planning	.763	.071	. 811	9.102	.000

a. Dependent Variable: Implementation

Conclusions

After reviewing the various research and survey findings of employee engagement, it can be concluded that high levels of employee engagement will lead to improved employee commitment & involvement towards job and consequently forming inspired personnel, who will work to attain the common organizational goals.

Attaining workforce experts is not enough in today's evolving economy like this one; rather many need to be done to hold, contain, and make employees dedicated to the organization and its goals. Therefore, engagement is a situation in which a person is not only intelligently devoted to his work but has countless emotive attachment with his job that goes beyond the duty call such that it's also beyond the Company's interest. All organizations should equip their staff with enough facilities and autonomy over their work to make it more exciting, providing an environment work-life balance. The organizations should apply retention strategies as an outcome area of the Human Resource concentration areas like staff enthusiasm, career development, growth, and compensation. Hence, working in a friendly environment to increase engagement level of an employee for higher productivity.

Acknowledgements

I would like to that the United Methods on Relief Services T employees for their participation in this study.

Conflict of Interest

The author declares no competing interest. The study was carried out for the sole purpose of generating new information on employee engagement. There is no individual or organization played any part that could influence the study outcomes.

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Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.08.02.Art003

Use of Topical Finasteride Vs Systemic Finasteride in Male Pattern Baldness

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Abstract

In this study we have analyzed the use of finasteride which is a type P-selective 5a-reductase inhibitor. By decreasing dihydroxytestestrone (DHT) level, it is found to be effective in the treatment of male androgenic alopecia. In this study, we compared the effect of topical vs. systemic finasteride in the treatment of androgenic alopecia. Our study is a randomized clinical trial study having 30 male patients. They have come for alopecia treatment at Nesam hospital, Coimbatore, India. We have selected male patients with androgenic alopecia and divided them into two groups (A, B), randomly having 15 patients in each group. For group A, Topical finasteride (0.1%) with minoxidil (5%) solution was given. Group B patients received topical minoxidil with oral finasteride (1mg) tablets. All patients were regularly followed up till the end of 6 months. A Patient had a first review in the first week followed by monthly follow up. Following parameters were taken into account: size of bald area, total hair count, and terminal hair. Data was analyzed by Chi-square statistical test. Each month the terminal hair, size of bald area and hair count between the two groups were compared. In the initial few months group, A showed good improvement. But Serial measurements indicated that a significant increase in hair counts and terminal hair counts is seen in both groups. This study showed that on long term follow-up of more than 3 months, both topical and systemic finasteride groups had similar results.

Keywords: *Androgenetic alopecia, Finasteride, Terminal hair.*

Introduction

Hair loss is the most common problem faced by modern society, which creates many psychological effects for the affected individual. The most common types of alopecia are baldness or androgenetic alopecia [1, 2, 3, 4]. Androgenetic alopecia (AGA) is the most common form of hair loss seen in genetically predisposed individuals. In androgenetic alopecia, there will be progressive narrowing of hair in the vertex and fronto temporal area of the scalp [5]. There will be high testosterone receptors in scalp of the involved person. Dihydroxytestosterone (DHT) is an active form of testosterone that is produced by enzyme type II, 5-a reductase from testosterone. High DHT level affects hair follicle, resulting in hair shaft thinning [6], shortening of anagen phase and prolongation of telogen phase [7]. Commonly used treatment for androgenic alopecia is composed of local minoxidil and oral anti-androgen or local progesterone-containing products. Finasteride reduces DHT level in blood by blocking type II 5α reductase. Finasteride is most commonly used in oral form. Oral intake of finasteride causes side effects such as decreased libido, erectile dysfunction, etc [6, 8, 9]. Once we stop oral finasteride, the DHT level rises and reverses its effects, resulting in less dense hair [1, 10]. This leads to an indefinite use of oral finasteride treatment. Various studies which show that topical finasteride appears to have results equivalent to oral finasteride in AGA, and it has better

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tolerance. So, we have conducted a study to assess the efficacy of topical minoxidil fortified with finasteride [11]. If topical form is effective, it will prevent the undesirable side effects of a systemic form of drug [12, 13]. It will be a suitable treatment for this social problem, especially in adolescence and young age groups in whom hair protection (for cosmetic reasons) is essential for them.

Materials and Methods

It is a randomized clinical study. We selected 30 male patients for this study. AGA patients with Hamilton grading 5a and 6; falling in the age group of 20-40 years were selected for this assessment. They were selected among patients coming to Nesam hospital, Coimbatore, India, with AGA, from September 2017 to February 2020. All of the subjects were having androgenetic alopecia, according to their history and clinical examination. Proper written consent was obtained from all the patients and a standard questionnaire was presented to all of them.

Inclusion Criteria

- Males between age group 20- 40 years,
- Hair loss duration less than 5 years;
- Maximum hair density 20 hairs/cm^2;
- Maximum diameter of the bald area less than 10 cm; and Having complete physical and psychological health.

Exclusion Criteria

- Patients with male alopecia that were under-treated, and
- Patients with baseline disease that causes hair loss.

Questionnaire Methods

We have prepared the two-part questionnaire. The first part mainly had questions about the demographic characteristics including age, sex, family status, education level, income, occupation and race. In the second half of the questionnaire, we collected information regarding the general health condition of the patient which includes history of diabetes, hypertension, heart disease, drug allergy etc. we have also recorded the information about hair loss like size of bald area, number of terminal hairs, and villus hair.

The patients entered the study based on inclusion criteria, and divided in two groups randomly; Group a Topical finasteride (0.1%) with minoxidil (5%) solution was given. Group B patients received topical minoxidil with oral finasteride tablets [14].

The patients in both groups are advised to use the solution twice daily by gently massaging their scalps. The total duration of the treatment was six months. We had a routine follow-up to evaluate the drug effectiveness, prognosis, and side effect. We have evaluated the patients at the beginning of the study and the end of first week of treatment, and then followed up monthly for 6 months. To assess the effectiveness of treatment we selected three areas of the scalp randomly [15, 16]. The size of each selected area is 10cm $^{2.}$ The size of the bald area, the number of total hairs and the number of terminal hairs were counted by the naked eye. We calculated the mean and the result was recorded.

To evaluate the total response to treatment, we have formed a scoring system.

Table 1 Therapeutic Response (based on Size of Bald Area)

S no	Size of Bald Area per cm	Score
1	8.1-9.5 cm	1
2	6.6-8 cm	2
3	5.1-6.5 cm	3
4	5.1-6.5 cm	4

Table 2. Therapeutic Response (based on Total Hair Count)

S no	Total Hair Count	Score
1	100-124	1
2	125-149	2
3	150-174	3
4	175-200	4

Table 3. Therapeutic Response (based on Number of Terminal Hairs)

S no	Number of Terminal Hair	Score
1	65-89	1
2	90-114	2
3	115-139	3
4	140-165	4

The resulting scores were summarized:

- score 3-6 - bad response,
- score 7-9 - moderate response,
- Score 10-12 - good response to the treatment.

Finally, the analysis was done by descriptive and Chi-square statistical approach.

Results

In group A, terminal hair count increased at the third month of treatment (P =0.001), but an increased in terminal hair count was shown in the second month itself in B group (P =0.015). During therapeutic period, the size of alopecia area was not significantly altered in group A, but in group B, the change in size of alopecia area was significant in the fourth month of treatment (P =0.027). Increased hair count in both the groups was significant in 4 months of treatment (P =0.001, in group A and P =0.000 in group B).

Discussion

In our study, after comparing topical and systemic finasteride [17], it was found that in second, third- and fourth-month follow-up, the therapeutic response to the tablet group was better than the topical solution group, but in the fifth and sixth months of treatment, the therapeutic response in both groups was the same (3). Also, in our study, the serial measurements of hair count and terminal hair showed that there is a significant increase in total hair count and terminal hair in both groups. Like other studies, the total hair in both topical and systemic finasteride group demonstrated significant differences between first referral and 6 months after therapy (P =0.000). This indicates the therapeutic efficacy of both drugs [9].

Conclusion

Our study shows that topical finasteride has considerable efficacy when it is used for male alopecia patients who have experienced hair loss in recent years. It can also be a good replacement for oral therapy, especially in those who worry about oral drug complications.

Conflict of Interest

There is no conflict of interest.

Acknowledgement

- I have prepared this paper with the help of many books, presentations and websites.
- Particular thanks to my guide Prof.Dr.K.Ravi and Dr.M.S.Abirami, who guided me in preparing this manuscript.

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Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.08.02.Art004

Microbial Assessment of Dried Fish Sold in Streets and Supermarkets in Harare Central Business District: Zimbabwe

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Abstract

The study focused on the microbiological quality of dried fish sold in the streets and supermarkets in Harare Central Business District. The analysis was based on determining the microbiological load of dried fish samples. Samples were systematically collected from three different streets and three different supermarkets each week. The study period was from January 2020 to April 2020.The samples were analyzed for Salmonella spp., Staphylococcus aureus, Escherichia coli, Aspergillus spp and Penicillium spp. The methods used were pour plate, streaking and microscopy. Results obtained from this study showed that street sold fish microbial levels were within unacceptable levels food safety standards. Supermarket sold dried fish microbial levels were also within the unacceptable levels. In comparing the levels of indicator microorganisms between streets and supermarkets, the results showed that the contamination of level was similar for all the microorganisms except Salmonella. Purchasing dried fish in supermarkets does not guarantee food safety. It was concluded that street and supermarket sold dried fish pose high food safety concerns and can be a potential source of foodborne illnesses.

Keywords: *Food borne illnesses, food contamination, Microorganisms, Microbial load.*

Introduction

Fish is a limbless cold-blooded vertebrate animal with gills and fins living wholly in water [1]. It is highly perishable. Fish is prone to contamination at various stages of handling and processing. Contamination is a very important aspect, as this is the mode that most unwanted microorganisms may be transmitted to seafood. Poor handling and storage facilities allow rapid post-harvest deterioration, thereby limiting availability of fish as stated [2]. There is substantial evidence that sea foods are high on a list of foods associated with outbreaks of food-borne diseases [3]. Bacteria are present on the surface slime, skin, gills and intestine of fish.

Fish harvested from eutrophic and warm waters will present higher bacterial numbers than fish from clean and cold waters, but potential human pathogens may be present in both cases [4].

The fungi associated with dried fish, the most prevalent fungi were *Aspergillus* and *Penicillium* species [2]. There is a general perception that street-vended foods are unsafe [5]. Food borne illness of microbial origin is a major international health problem associated with food safety in developing countries [6]. Potential health risks are associated with contamination of fish by *Escherichia coli*, *Salmonella typhi*, *Pseudomonas spp*, *Staphylococcus aureus* and *Proteus spp* during preparation, post cooking and handling.

Fish is sold in different varieties, namely haddock, hake, mackerel, cod, herrings, bream, trout and kapenta amongst others. In a study carried out in the rural and urban areas of Zimbabwe [7], mackerel, bream and dried

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kapenta are the most consumed fish species. Lake Chivero is hypereutrophic due to high levels of pollution, with major sources of pollutants being sewage and industrial waste. Bream caught by local fishermen in small reservoirs is usually sold fresh, smoked or dried to people in the nearby area. For the majority of urban residents who are low on incomes lower value fish such as mackerel, bream and kapenta are on greater demand [7]. Different water bodies have different physical, chemical, and biological characteristics which influence the plankton, diversity of prey in water bodies, and the substances to which the fish are exposed, henceforth offering different environments and nutrient sources [8]. Fish is a healthy food, rich in quality animal protein, polyunsaturated fatty acids especially the (ω)-3 eicosapentaenoic acid and docosahexaenoic acid, vitamins (A, D, E, K), water-soluble vitamins B complex, vitamin C and micronutrients [9].

Harare is known to harbour cases of water-borne disease outbreaks like typhoid. An estimated number of 30000 people suffer from food-borne diseases annually [10]. Due to faltering economic development as a result of various factors, street food vending has become increasingly important in the economies of many African countries. Street foods are a source of inexpensive, nutritious meals. There is a general perception that street-vended foods are unsafe, mainly because of the environment under which they are prepared and consumed, which exposes the food to numerous potential contaminants. Some studies, however, have shown that food prepared on the street can be safe, thereby providing alternative outlets for consumers [11, 12].

Statement of Problem

According to the 2018 health statistics on cholera outbreak in Zimbabwe, there has been a rapid increase in the number of suspected cases reported per day. A total of 3621 cumulative suspected cases, including 71 confirmed cases, and 32 deaths were reported. This gives a case fatality ratio of 0.8%, out of which 98% (3564 cases) were reported from the densely populated capital Harare [13]. This is suspected to have been caused by poor sanitation and a lot of illegal vending activities, due to the high rate of unemployment. People prefer purchasing dried fish because it is cheap, convenient and there is no need for refrigeration [7]. However, street-sold fish are considered among the contributors to foodborne diseases. Microorganisms such as *Escherichia coli* can be pathogenic causing illnesses.

It is in this regard that there was a need to identify the pathogenic microbes present in street sold dried fish. The safety of eating dried fish from informal market was not known thereby possibly posing risks for human health despite the fish being preserved using hurdle technology. It was against this background that the researcher undertook this study.

Research Objectives

1. Determine the microbial load for selected microorganisms related to food borne illnesses for both street and supermarket vended dried fish.
2. Compare the microbial load for the selected microorganisms from the supermarket and streets dried fish.
3. Compare the microbial load of these to world health standards for the microbial load on fish.

Literature Review

Microorganisms Associated with Fish

The initial microflora of fish can contain human pathogenic bacteria, posing a concern for seafood borne illnesses [4, 12]. Unwanted microorganisms may access fish processing environments through raw material, personnel or mobile equipment, through leakage and openings in buildings or through pests and some pathogens may even become established in the processing plant and form niches where they can survive for long periods of time, Fish consists of on average 70% water, in fatty fish it has a

percentage of about 65% and in lean fish about 80% [14, 15]. Hence, with such high levels of internal moisture, bacteria can grow rapidly.

Foodborne bacterial pathogens commonly detected in street vended foods in developing countries include *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus aureus* and *Salmonella spp* [16]. Street foods are often prepared by hand, which may lead to an increased incidence of contamination with the potential foodborne pathogens. *Escherichia coli* is a classic example of enteric bacteria causing gastroenteritis. *Escherichia coli* including other coliforms and bacteria as *Staphylococcus spp* and sometimes enterococci are commonly used as indices of hazardous conditions during processing of fish [17]. Contamination of food of fish origin with pathogenic *Escherichia coli* probably occurs during handling of fish and during the production process [18]. Inadequate processing of raw products or cross contamination of raw materials and prepared foods and poor time and temperature control is a contributing factor for multiplication of *Escherichia coli* [19]. Presence of *Escherichia coli* indicates potential for there to have been contamination of faecal origin from poor hygienic practices or there has been inadequate processing.

Fish appear to be passive carriers of *Salmonella*, demonstrate no clinical disease, and can excrete *Salmonella spp*. Contamination of this organism derives from terrestrial sources and fish may serve as a vector for *Salmonella spp*. *Salmonella* is likely caused by inadequate processing of raw products, cross contamination or contaminated raw materials and poor time and temperature control [17, 19]. Enterotoxins produced by *Staphylococcus aureus* are another serious cause of gastroenteritis after consumption of fish. *Staphylococcus aureus* is likely caused by inadequate temperature control and poor hygienic practices [19].

Dried fish rely on a combination of salt and heat treatment for their safety [20]. If the product has insufficient salt, or fails to achieve a required temperature, *Clostridium botulinum* can grow. Some fungi are thought to enhance the acceptability of the product while others indicate spoilage, but the main concern is the presence of toxigenic fungi and their toxic metabolites [21]. Dried fish are dominated by *Aspergillus* species that include several important mycotoxin producers during a study of fungal spoilage of dried fish from Indonesia [21]. Less specialised xerophiles (*Eurotium* and *Aspergillus* species) cause spoilage in these products if they are not dried quickly to a safe moisture level, or if they are stored in humid environments where water may be reabsorbed [21]. *Penicillium* is a diverse genus which causes destructive rots in the food industry, where they produce a wide range of mycotoxins [22].

Practices used during food preparation such as handling, cleaning, sorting and grading, packaging, storing and wrapping in low grade plastics are some of the critical factors that increase the risk of inadequate food safety [23]. Foodborne bacterial pathogens commonly detected in street vended foods in developing countries include *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus aureus* and *Salmonella spp*. The consumption of street foods potentially increases the risk of food-borne diseases caused by a wide variety of pathogens which include *Escherichia coli, Salmonella typhi, Pseudomonas spp., Staphylococcus aureus* [24].

They can contribute to foodborne illnesses as a result of presence of chemical hazards, heavy metals and process contaminants they may contain. Henceforth the quality of street vended food is of great food safety concern, as consumers are continuously exposed to the risk of getting ill [25]. *Salmonella spp* and *Staphylococcus aureus* are the most common foodborne pathogens responsible for food poisoning and food-related infections [26]. Food-borne illnesses are a widespread problem globally.

The microbiological quality of informally vended foods in Harare sadza and stews had few

contaminated samples by *Bacillus cereus* and *Salmonella spp* [12]. The application of hygienic practices during the preparation and sale of street food could reduce microbial risk associated with street vended food [26]. Street food plays an important socio-economic role, it provides a regular source of income for millions of low or unskilled people in developing countries [7].

Microbiological foodborne diseases immensely influence the economies of developing countries in a negative way, most of the outbreaks have been closely linked to a number of factors including use of microbiologically poor-quality raw materials in food preparation, improper handling of prepared foods and unsound vendor hygiene practices among others [26]. In many instances, street-food vendors are uneducated and untrained in basic food hygiene and pre-requisite systems. In South Africa, the researchers stated that the overall hygiene of pre-prepared street food is poor [28, 29]. A study in Santa Fe de Bogota, Colombia revealed that over 30% of a group of food handlers examined were carriers of pathogenic microorganisms including *Salmonella typhi*, *Staphylococcus aureus*, *Salmonella enteritidis* and *Shigella* [30].

Sources of Fish Contamination

Many pathogenic bacteria are naturally present in the aquatic environment [3]. Other microorganisms are of the animal or human sources, particularly *Salmonella*, *Shigella*, and *Escherichia coli*. Thus, there is always a possibility that these microorganisms may be passed on to the raw material during production and processing [3]. During the processing of dried fish, other ingredients such as salt and spices could be potential sources of contamination. Contamination of fish products through processing equipment is a source of contamination [14]. Unclean, insufficient or inadequate cleaned processing equipment has been identified as a source of bacterial contamination in processed fish. Containers, pumps or tanks used for holding or transporting unprocessed raw materials, have occasionally been used for processed products without any cleaning and disinfection [31].

Water, is a vehicle for transmission of many agents of diseases and it continues to cause significant outbreaks of disease in developed and developing countries worldwide [32]. Potable water should be used throughout the production process for cleaning equipment and washing fish [33]. Transfer of microorganisms by food handlers is a major source of contamination. Poor hygiene and or absence of hand washing has been identified as the causative mode of transmission [14].

Standards Regarding to the Safety of Dried Fish

There is no universal agreement on which indicator microorganism(s) is most useful, henceforth different indicators and different indicator levels identified as standards are used in different states, countries, and regions [34]. Microbiological criteria for fish products include quantification of the counts of *Escherichia coli* is performed during the production. At the finished product stage, the measure monitored is the quantification of the count of *Staphylococcus aureus* and detection of bacteria of *Salmonella* genus, as their presence indicates recontamination of a finished product.

Food Standards Australia New Zealand stated that [20], Microbiological assessment is defined based on the detection or level of microorganism found under the following: Satisfactory**,** results will be within expected microbiological levels and present. There is no food safety concern, and no action is required. Marginal is when results are within expected microbiological levels but are at the upper range. Some action may be required to ensure food handling controls continue to be effective. Unsatisfactory, this is when the results are outside expected microbiological levels and indicate poor food handling practices.

Further actions are required to re-establish effective food handling controls.

Microbiological guidelines are used by regulatory agencies to check that food for sale is safe and suitable and the food handling controls and hygienic practices of a food business are adequate. Guideline criteria indicate whether the microbiological status of a food product is within the normal or acceptable range and in this way are alert mechanisms to signal conformance with food safety controls. Potentially hazardous is when the results exceed expected microbiological levels to a level that presents an immediate food safety concern. Further action is required to prevent affected product still available from being distributed or sold to determine the likely source or cause of the problem and ensure corrective actions are implemented [1] (Table1.0).

Table 1.0. Interpretation of Levels of Microorganisms in Accordance to (FSANZ, 2016)

Indicator	**Result (cfu/ml)**	**Interpretation**
Escherichia coli	$>10^2$	Unsatisfactory
	$3- < 10^{-2}$	Marginal
	< 3	Satisfactory
Salmonella	$>10^4$	Unsatisfactory
	$10^2 - 10^4$	Marginal
	$< 10^2$	Satisfactory
Staphylococcus aureus	$>10^4$	Potentially hazardous
	$10^3 - \leq 10^4$	Unsatisfactory
	$10^2 < 10^3$	Marginal
	$< 10^{-2}$	Satisfactory
Yeasts and moulds	5×10^6	Acceptable
	3×10^7	Unacceptable

Materials and Methods

Sample Collection

Research data is any information that has been collected, observed, generated or created to validate original research findings. The data was collected at six different sites in Harare CBD [35]. Three sites were for street sold dried fish while three other sites were for supermarket sold dried fish. Three sites were used for both supermarket and street sold dried fish to improve accuracy of the research. Dried fish were bought from supermarkets and street vendors in Harare CBD. Dried fish were aseptically transferred into sterile stomacher bags and labelled with identities from location of collection. Dried fish samples were transported to the laboratory for testing.

Study Area

The study took place in Harare. Sampling was done in Harare CBD and supermarkets; experiments were done at the University of Zimbabwe. The study took place in six different sites in Harare. Sampling of the dried fish and experiments for the microbial analysis were carried out from January to April 2020. The one hundred and eighty samples were aseptically transferred into sterile stomacher bags.

Preparation of Agar Mediums and Broths

Different types of agar mediums and medium broths were prepared. The solutions were put in universal bottles. Lids were put on universal bottles and closed. The universal bottles were wrapped with aluminium foil just in case the contents were likely to explode. The autoclave was used to sterilise the medium. Sterilisation in an autoclave was done under pressurised steam at a temperature of 121˚C for 15 minutes. The universal bottles and pipettes in aluminium foil were removed from the autoclave and left to cool.

Preparation of Petri Dishes

The petri dishes were labelled using sellotape. The media was poured into petri dishes. The different types of prepared agar solution were poured into petri dishes such that 12-15 ml of agar medium was put. After pouring the agar medium, all petri dishes were kept in room temperature so that agar medium solidified. The petri dishes were inoculated upside down. The samples were spread on the medium surface rapidly in a smooth back and forth motion. Swirling the cell suspension was done before removing aliquot for plating. A metal loop was flamed with a Bunsen burner before obtaining inoculum for the plate. The spread plate method was a technique used.

Experimental Design

A total of 180 samples of dried fish were systematically randomly purchased from six different sites in Harare. Eighteen samples were collected at each location. The samples were analysed according to the Official Methods of Analysis of AOAC International.

Determination of Escherichia coli

Ten grams of each dried fish sample was weighed into a stomacher bag and homogenised. Addition of 90ml of 0.1% of Trypticase Soy Broth (TSB) into the stomacher bag with the homogenised sample followed. The sample and diluent were mixed together. Serial decimal dilutions were made. *Escherichia coli* was enumerated using the most probable number method. Pure colonies were sub cultured in peptone water, incubated at 37°C for 24 hours. After incubation, the broth will be streaked on to MacConkey agar and incubated for 24 hours at 37ºC.

Determination of Salmonella

Ten grams of each dried fish sample was weighed into a stomacher bag and homogenised. Addition of 90ml of 0.1% of Buffered Peptone Water (BPW) broth into the stomacher bag with the homogenised sample followed. The sample and diluent were mixed together. Serial decimal dilutions were made. Brilliant Green Agar (BGA) was poured into each petri dish. The inoculated plates were incubated at 37°C for 24 hours under aerobic conditions.

Determination of Staphylococcus Aureus

Ten grams of each dried fish sample was weighed into a stomacher bag and homogenised. Addition of 90ml of 0.1% of Buffered Peptone Water (BPW) into the stomacher bag with the homogenised sample followed. The sample and diluent were mixed together. Serial decimal dilutions were. Mannitol Salt Agar (MSA) was poured into each petri dish. The inoculated plates were incubated at 37°C for 24 hours.

Determination of Aspergillus and Penicillium

Ten grams of each dried fish sample was weighed into a stomacher bag and homogenised. Dried fish were examined under a magnifying lens for fungal growth. Pieces of mycelia or spores were picked from the surface using a sterile needle and transferred to inoculating media, Potato Dextrose Agar (PDA) and Malt Extract Agar, respectively. The dried fish were also press-plated in the same media. The petri dishes were incubated at 25˚C for 7 days in a dark place. The visible growths were identified. This procedure was adopted and adapted from [2].

Results and Discussion

Below are results of the microbial levels in fish from both the streets and the supermarket.

Samples from Hellena Street had the highest levels of *Salmonella*. All samples were contaminated with *Escherichia coli*, *Salmonella*, *Staphylococcus aureus* and *Aspergillus* [24] who stated that in street foods potentially increase risk of food-borne diseases. *Aspergillus* was detected in very low levels; this might have been caused by insufficient drying of the dried fish to safe moisture levels [21]. *Aspergillus* is most likely to be caused by not drying fish to a safe moisture level [21].

Hellena Street samples had highest levels microbes probably because the fish were not wrapped in any packaging material exposing the fish to various microorganisms as compared to other sites, though the packaging material was of inferior quality. *Penicillium* was not detected at Tol Street, this might have been caused by effective preservation methods [15] who said that when sufficient water is removed from fish, microorganisms can no longer grow. High levels of *Salmonella* this might have been caused by inadequate processing of raw fish [20] who stated that *Salmonella* is likely caused by inadequate processing.

Results on Pathogenic Microorganisms obtained from Street Sold Dried Fish

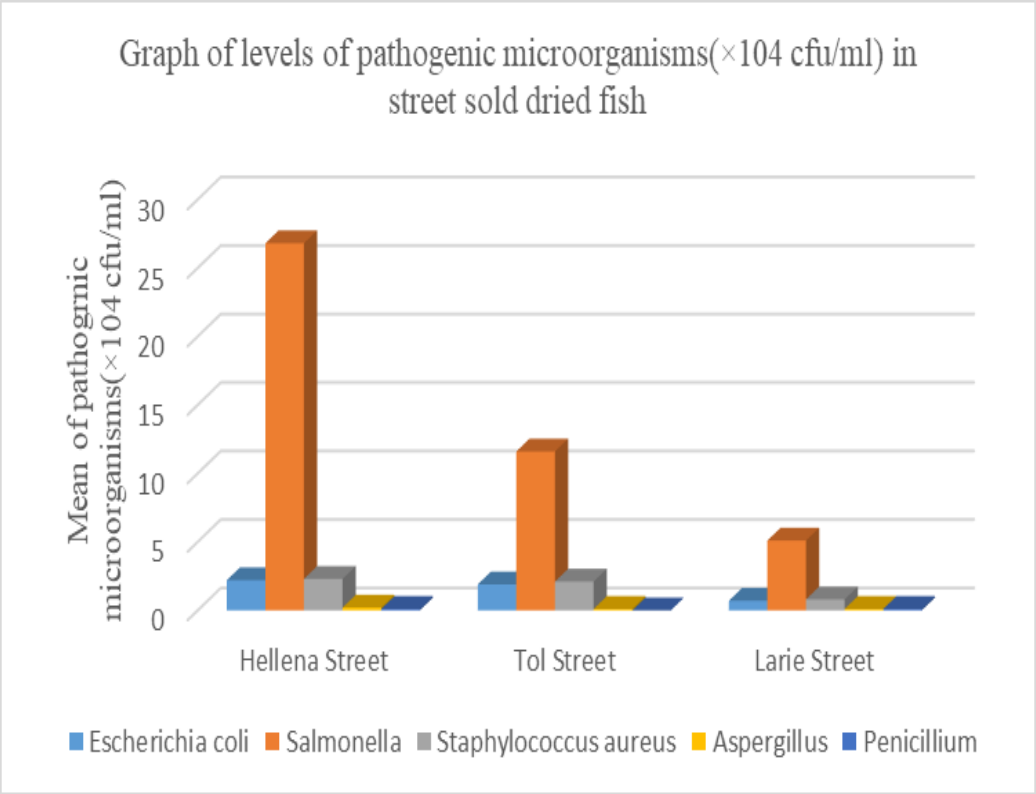

Figure 1. Mean of Pathogenic Microbes in Street Sold Dried Fish Collected from Different Streets

Results on Pathogenic Microorganisms Levels in Supermarket Sold Dried Fish

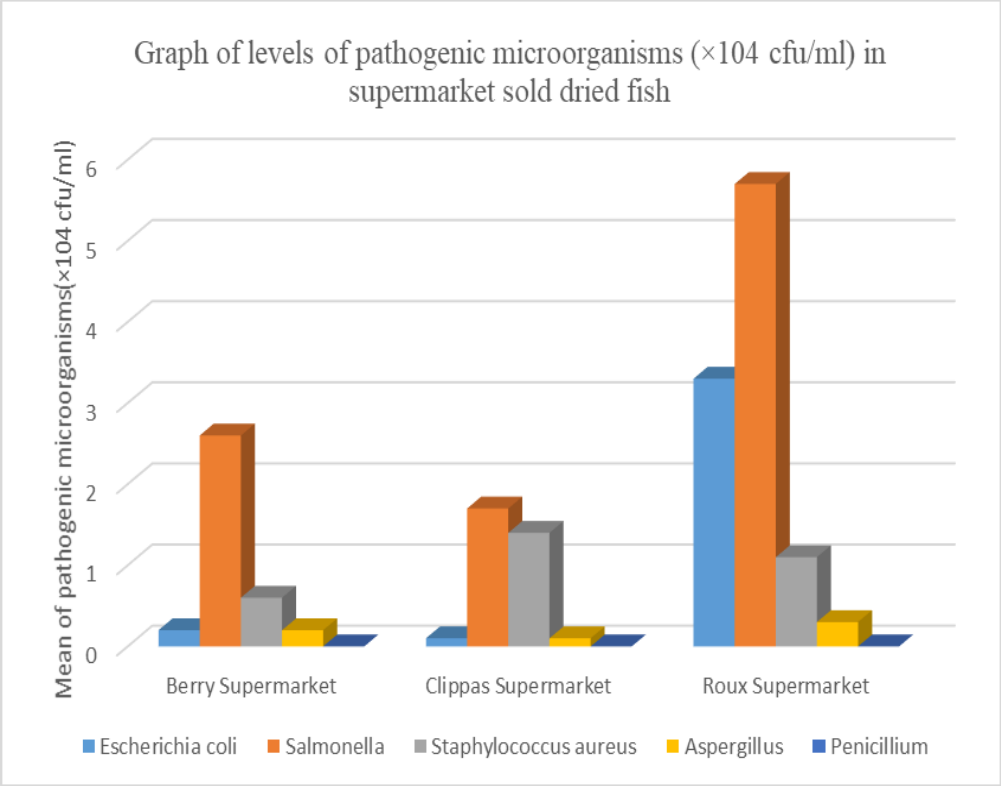

Figure 2. Mean of Pathogenic Microbes in Supermarkets Sold Dried Fish Collected from Different Supermarkets

Results indicate that samples from Roux Supermarket had the highest levels of *Salmonella* and *Escherichia coli*. Presence of *Salmonella* might have been caused by poor time and temperature control [20] which states that *Salmonella* is likely caused by poor time and temperature control. Presence of *Staphylococcus aureus* might have been caused by poor hygienic practices during handling and processing of fish [20] who stated that *Staphylococcus aureus* is likely caused by poor hygienic practices during handling and preparation. *Aspergillus* was relatively low in supermarket sold dried fish. Detection of *Aspergillus* might have been due to the fact that the fish might have been stored in a humid environment, as suggested [21] (Table 1.2).

The supermarket sold dried fish samples were not contaminated with *Penicillium* (Table 1.1). This indicates effective preservation of the fish as stated by [15] who cited that when sufficient water is removed from fish, microorganisms can no longer grow. Low levels of fungi might have been attributed to the good quality packaging material [23] who cited that wrapping in low grade plastics increases the risk of inadequate food safety, in the supermarkets food safety risk was reduced owing to choose of packaging material.

The *E. coli* and *Salmonella* levels in both the streets and supermarkets were in the unsatisfactory range [20], This is when the results are outside expected microbiological levels and indicate poor food handling practices [20]. Hellena Street had the highest levels of *Escherichia coli*. Higher values greater than 100 cfu/ ml were recorded in all the streets, rendering the dried fish unsafe. Presence of *Escherichia coli* on fish is a clear evidence of contamination from terrigenous source [33]. *Salmonella* levels were high on the different streets. Presence of *Salmonella* indicate poor food handling practices [20]. hence there are food safety concerns and is required.

Staphylococcus aureus levels for all six sites were in the potentially hazardous range [20], which is when the results exceed expected microbiological levels to a level that presents an immediate food safety concern. Presence of *Staphylococcus aureus* might have been due to contamination during processing [3], who said that *Staphylococcus aureus* is caused by contamination or recontamination of seafood during processing. *Aspergillus* and *Penicillium* were well within acceptable ranges. The main concern is the presence of toxigenic fungi and their toxic metabolites [21]. but in this case the levels were low.

Results of the comparison levels of pathogenic street and supermarket sold dried fish were established using two tailed t-tests. $P > 0.05$ at 95% confidence level therefore we can say that there were no significance differences between the street sold and supermarket sold dried fish with regards to the level of pathogenic microorganisms.

There were no significant differences in the levels of pathogenic microbes between supermarket and street sold dried fish for *Escherichia coli*, *Staphylococcus aureus*, *Aspergillus* and *Penicillium*. This might have been due to the fact that most supermarkets do not carry microbial tests on incoming food products, they usually carry acceptance tests by use of sensory evaluation. This might have been also due to the fact that, in most instances, street vendors are uneducated and untrained in basic food hygiene and pre-requisite systems [26]. Some of the street vendors stock their dried fish in drainages to avoid harassment by city authorities displaying a relatively small number of dried fish on the street pavements, thereby posing health risks to consumers.

There was a significant difference in the levels of *Salmonella* between supermarket and street sold dried fish. This might have been caused by recontamination of dried fish [36] detection of *Salmonella* indicates recontamination of a finished product. Supermarkets usually receive products from processing companies and these companies carry out quality control tests as opposed to street sold dried fish where recontamination is likely to occur. In the processing of dried fish, poor time and temperature control might have caused *Salmonella* proliferation [20] due to lack of proper processing equipment like thermocouples and automated temperature recording devices.

Safety of the Street and Supermarket Sold Dried Fish Results according to (FSANZ, 2016) Guidelines

Table 1.1. Interpretation of Levels of Microorganisms in Street and Supermarket Sold Dried Fish

Indicator microorganism	**Street sold dried fish mean ($\times 10^4$cfu/ml)**	**Supermarket sold dried fish mean ($\times 10^4$cfu/ml)**	**Interpretation**
Escherichia coli	1.60	1.20	Unsatisfactory
Salmonella	14.5	3.33	Unsatisfactory
Staphylococcus aureus	1.73	1.03	Potentially hazardous
Aspergillus spp	0.13	0.20	Satisfactory
Penicillium spp	0.07	0	Satisfactory

T-tests Results on the Comparison between Street and Supermarket Sold Dried Fish at p > 0.05 at 95% Confidence Level

Table 1.2. T-tests Results on the Comparison between Street and Supermarket Sold Dried Fish

Indicator microorganism	T calculated	Hypothesis results
Escherichia coli	0.35	Accept H_0
		Reject H_1
Salmonella	17.05	Accept H_1
		Reject H_0
Staphylococcus aureus	1.36	Accept H_0
		Reject H_1
Aspergillus	1.19	Accept H_0
		Reject H_1
Penicillium	0.71	Accept H_0
		Reject H_1

T tabulated value = 2.776

Practical Analysis during the Research



Plate 1. The culture Media and Pipettes in Autoclave (sterilisation)



Plate 2. Start of incubation process



Plate 3. Results of the incubation process



Plate 4. Sample of Dried Fish

Conclusion

From the findings, street and supermarket sold dried fish microbial levels were within the unacceptable standards. Detection of these microorganisms is of great food safety concern and poses health risks to the consumers. Presence of these microorganisms might have been caused by lack of knowledge of basic food hygiene by food handlers. Poor time and temperature controls could have caused a proliferation of microorganisms. Use of unclean water during preparation and processing of the fish might have contributed to the presence and proliferation of microbes. In comparing the levels of indicator microorganisms between streets and supermarkets, the results showed that they were no significant differences except *Salmonella*. Recontamination of dried fish as well as inadequate processing might have caused the difference. Purchasing dried fish in supermarkets does not guarantee food safety. Packaging material, storage conditions, time-temperature combinations during processing, salt concentration, method of salt addition to the fish play a pivotal role in the final dried fish. In conclusion, street and supermarket sold dried fish poses high food safety concerns, they can be a health risk to consumers and can be a potential source of foodborne illnesses.

Conflict of Interest Statement

The authors Joe Phaeton Mukaro, Fenton Ruparanganda and Primrose Katsande declare that there are no conflicts of interest.

Acknowledgements

Authors would want to acknowledge the Ministry of Local Government of Zimbabwe and Harare City Council for allowing the authors access municipal facilities in order to carry out the research.

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Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.08.02.Art005

Reliability of Rapid Diagnostic Tests in the Diagnosis of Malaria amongst Children attending the Outpatient Department of the Tetteh Quarshie Memorial Hospital in the Akuapem North District of the Eastern Region of Ghana

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Abstract

Treatment of malaria, with the appropriate diagnostic tool, helps to reduce morbidity and mortality in children. The absence of resources and inadequate labor in emerging countries like Ghana make malaria microscopy difficult. The Rapid Diagnostic Test kit (RDT) remains unpopular despite its availability and ease of use because of limited research on its effectiveness leading to over- prescription of antimalarial drugs. This study shows how reliable the malaria diagnostic test is. Out of 132 children were recruited in all into the study with more females (59.1%) than males (40.9%). 35 (26.5%) of children who were recruited tested positive for Plasmodium falciparum with the Malaria rapid diagnostic test cassette while 97 (73.5%) children tested negative for Plasmodium falciparum with the malaria diagnostic test cassette. In Malaria Microscopy, 35 (26.5%) children tested positive while 97 (73.5%) tested negative for malaria parasites. Out of the 35 children who tested positive, RDT picked 33 as positive and 2 as negative (sensitivity = 94.3%). While out of the 97 that tested negative for microscopy, RDT picked 94 as negative and 3 as positive (specificity= 96.9%). The positive predictive value and negative predictive values are 91.7% and 97.9%, respectively. This clearly shows the Rapid Diagnostic Test (RDT) is an effective diagnostic tool for the testing of malaria in children in the Akuapem North District in the Eastern Region of Ghana.

Keywords: *Histidine-rich protein 2 (HRP2), Malaria, Out Patient Department (OPD), Rapid Diagnostic Test (RDT).*

Introduction

Malaria is one of the life-threatening parasitic diseases transmitted to people through the bites of infected adult female *Anopheles* mosquitoes. It is caused by *Plasmodium* parasites [1]. Currently, five parasite species are known to human malaria, and 2 of these species – *P. falciparum* and *P. vivax* – present the highest threat. *Plasmodium falciparum* which is the most common malaria parasite in Africa causes most malaria-related deaths worldwide. *Plasmodium vivax*, on the other hand, is the main malaria parasite in countries outside sub-Saharan Africa [2].

According to the World Health Organisation (WHO), there was a decline in malaria-related mortality globally by 37% in 2016. Additionally, the African region persists in having an unduly high proportion of the global burden of malaria. In 2017, the region recorded 92% of malaria cases and 93% of malaria mortality [2]. Globally, the WHO approach to malaria control efforts are based on vector control and improved diagnosis and treatment of patients with clinical malaria [3]. However, to a very large extent, accurate and early diagnosis of malaria is the main determinant of malaria management and treatment. Improving case management and

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reducing malaria morbidity and mortality rates can be achieved by using malaria rapid diagnostic tests (MRDTs) [4, 5]. RDTs were employed in 75% of all diagnostic testing used to evaluate suspected malaria cases in Africa [2]. In Ghana and all of Africa, RDTs are now first choice diagnostic tools for malaria diagnosis. Various malaria RDTs available capture at least four target antigens which include P. falciparum histidine-rich protein 2 (HRP2) and lactate dehydrogenase (LDH), and the pan-plasmodial aldolase and LDH [6].

The most widely used RDT is PfHRP2. Histidine-rich protein 2 (HRP2) is an antigen-specific to P. falciparum. Though it is highly abundant and heat stable, it is still detectable in the blood for up to a month after malaria parasite clearance [7]. In addition, PfHRP3, which is structurally similar to PfHRP2, has been shown to cross react with certain monoclonal antibodies directed against PfHRP2 [8]. It has further been demonstrated that PfHRP2 based RDTs can produce false-positive results when the circulating HRP2 antigen persists even after antimalarial treatment, and false – negative results when parasitaemia levels fall below around 200 parasites/µL which is the detection limit for most RDTs which are commercially available [9].

With the appropriate diagnostic tool, Treatment of malaria helps to reduce morbidity and mortality in children. The absence of resources and inadequate labor in emerging countries like Ghana make malaria microscopy difficult yet, the Rapid Diagnostic Test kit (RDT) remains unpopular despite its availability and ease of use, but because of limited research on its effectiveness has to lead to over-prescription of antimalarial drugs.

Materials and Methods

Study Site

The study was carried out at the Tetteh Quarshie Memorial Hospital, which is located in the Akuape m North District of the Eastern Region of Ghana. The Akuapem North District lies between longitude 0º 00º E and 0º 20º E of Greenwich Meridian and latitude 5º 51º and 6º 10º north of the equator. The District shares boundaries with four other Districts within the Eastern Region and one in the Greater Accra Region. The four Districts are Suhum Kraboa Coaltar in the West, New Juaben in the North West, Yilo Krobo in the North East and Akuapem South on the South side. Dangbe West in the Greater Accra Region shares boundary with the District in the Southwest. Originally created as an ordinary district assembly in 1988 from the former Akuapem District; until it was elevated to municipal district assembly status on 15 March 2012 by two distinct seasons, the mean annual rainfall is 1270mm (50in). The mean temperature is 23.88ºC (75ºF). Rainfall pattern has two maximals from May to July and September to November. Minor Dry Season is in August and Major Dry Season is from December to February. The peak malaria transmission coincides with major rains, while the dry season has low rates of malaria infection [10].

Inclusion Criteria

Children between the ages of 1 to 8 years attending the outpatient department (OPD).

Exclusion Criteria

Children above 8 years and below 8 years who are on admission were excluded from the research.

Laboratory Procedures

A total of 132 children age range 1-8 years attending the OPD were screened for malaria using a rapid diagnostic test kits (RDTs HRP 2) which was followed by malaria microscopy at the medical laboratory department of the Tetteh Quarshie Memorial Hospital located in the Akuapem North district in the Eastern region of Ghana . Malaria rapid test cassettes were labeled with patient ID (name and pathological number). Then the fourth finger was disinfected and allowed to air dry before the finger was pricked and the first drop of blood wiped off with dry cotton. A Capillary tube was used to draw the

whole blood specimen and transferred into the well-marked(S) sample on the cassette. Result is read within a minimum of 15 minutes and maximum of 20 min (per manufacturer's instructions). The test results was then documented.

Thick and thin blood films were made, thin-film fixed with methanol, thin and thick film stained with 10% Giemsa and examined for malaria parasites. Parasite density was measured as the number of parasites per 200 leucocytes on a thick film and converted into parasites per microliter of blood based on the participants total white cell count obtained at enrolment. Both positive and negative slides were randomly selected and read by an independent microscopist as a quality control check. Two hundred high power fields of the thick films were examined at ×100 oil immersion magnification before assigning a negative result.

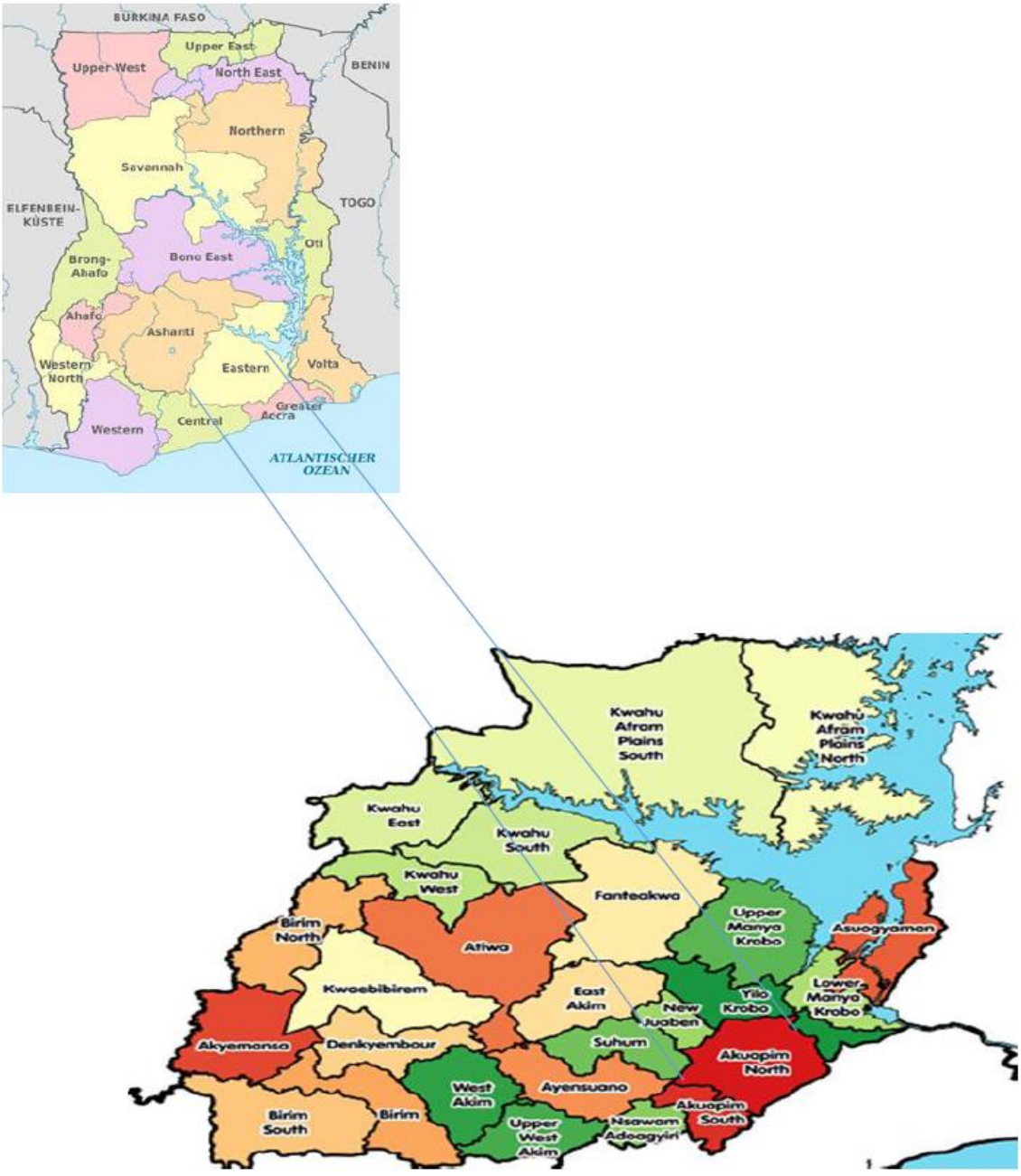

Figure 1. Regional Map of the Eastern Region showing the Akuapem North District of Ghana

Results and Discussion

132 children were recruited in all into the study with more females (59.1%) than males (40.9%) and this could be the reason that women in that district will normally stay out with their daughters in the evening in the name of teaching them the basic roles of a woman (girl child) in the family usually exposing them to mosquitoes. 35 (26.5%) of children who were recruited tested positive for Plasmodium falciparum with the Malaria rapid diagnostic test cassette, while 97 (73.5%) children tested negative for Plasmodium falciparum with the malaria diagnostic test cassette.

In Malaria Microscopy, 35 (26.5%) children tested positive while 97 (73.5%) tested negative for malaria parasites. Out of the 35 children who tested positive, RDT picked 33 as positive and 2 as negative (sensitivity = 94.3%). While out of the 97 that tested negative for microscopy, RDT picked 94 as negative and 3 as positive (specificity = 96.9%). The positive predictive value and negative predictive values are 91.7% and 97.9%, respectively.

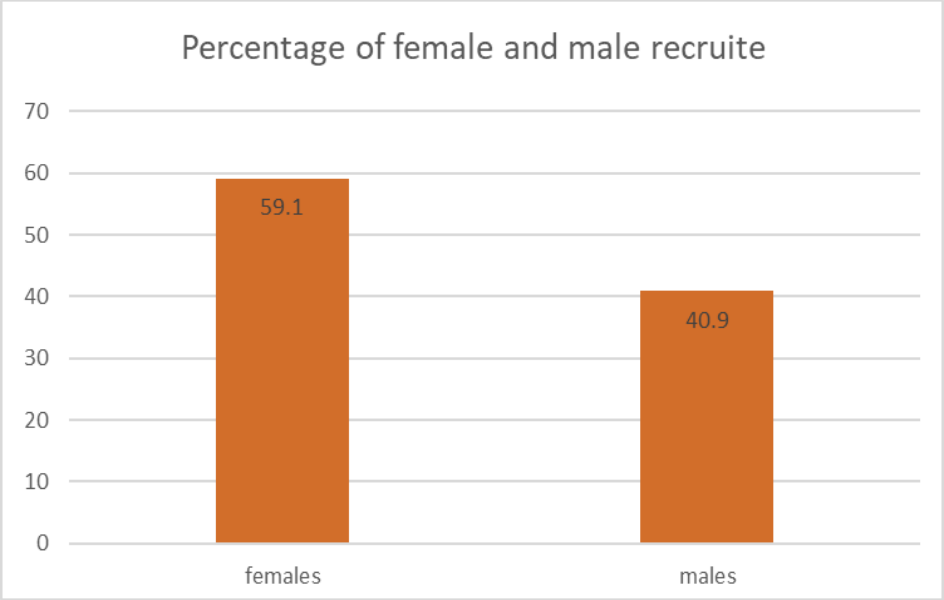

Figure 2. The Percentage of Male and Female Recruit attending the OPD

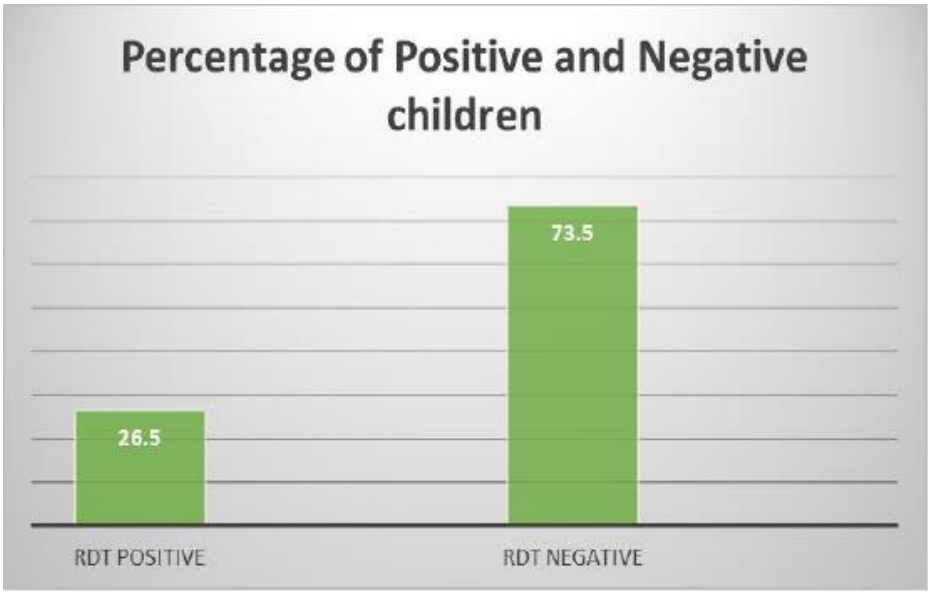

Figure 3. The percentage of Children who Tested Positive and Negative for RDT

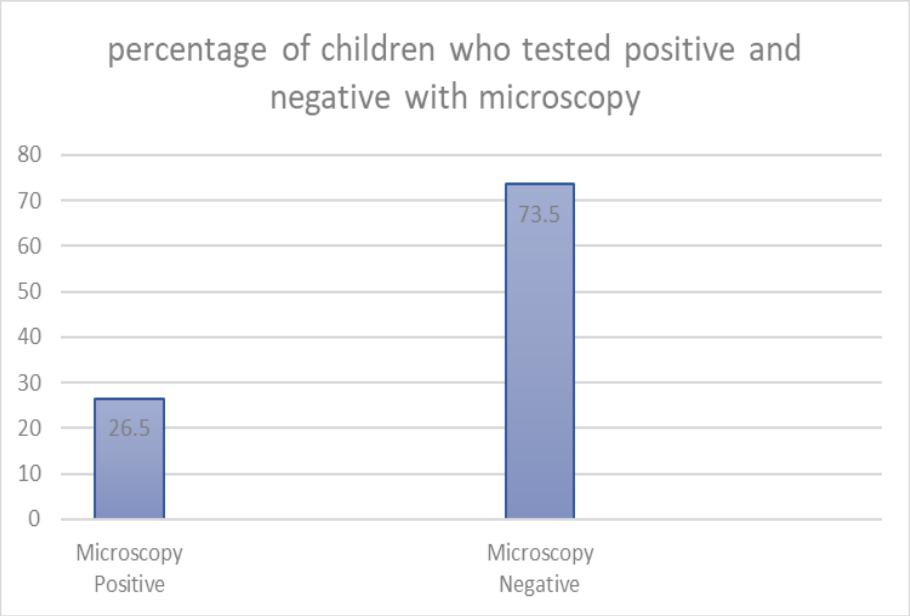

Figure 4. The Percentage of Children who Tested Positive and Negative with Malaria Microscopy

Conclusions

Rapid Diagnostic malaria for (RDT) is an effective diagnostic tool for testing malaria amongst children in the study population. Teaching Hospitals, District Hospitals, Health Centers, and Polyclinics should be encouraged to use it hand in hand with the "golden standard" microscopy to ugment for the shortage of manpower in medical laboratory and also for the effective treatment of malaria to reduce the excessive administration of Antimalarial drugs to patients who present symptoms of malaria to health facilities.

Conflict of Interest

There is no conflict of interest.

Acknowledgment

I will like to express my gratitude to Dr. Charlse Brown of the University of Ghana and Alhaji Munkaila Ibrahim, the Head of the Medical Laboratory Department of the Tetteh Quarshie Memorial Hospital for their contribution towards this work.

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Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.08.02.Art006

How do Nigerian Gynaecologist in a Tertiary Health Facility Manage Infertile Patients for Sexual Dysfunction?

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Abstract

This study was conducted to evaluate the approaches gynaecologists in Osun East Senatorial district; South west Nigeria uses to screen and manage their infertile women for sexual dysfunction. Forty gynaecologists and their resident doctors managing infertile women at Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife, Nigeria, were interviewed (June -December 2020) using an in-depth-interview guide and semi-structured questionnaires. All the forty doctors assessed the sexual functioning of infertile patients. The Assessment was usually done at the first time of seeing the patient and at other times when patients start a discussion about it or when a patient's complaints are directly related to it. Ways of eliciting sexual concerns were by asking on the frequency of sexual intercourse per week, about ejaculatory intercourse, sexual satisfaction, and dyspareunia. None of them used any standardized assessment tools to screen infertile women. Most are not aware of any standardized tools for sexual functions assessment because they had no training in sexual dysfunction in both undergraduate and postgraduate training as it was not in their curricula. While they welcome the introduction of the tools in training and in the case file of patients, they believed that routine screening using these tools would increase the waiting time and would be an added burden on the doctors. This study showed that gynaecologists and residents are poorly equipped to address sexual problems and sexual dysfunction among infertile women. It is imperative that the curricula of medical training be updated to include assessing sexual functioning tools for better care.

Keywords*: Female sexual dysfunction, Nigerian gynaecologist, Management.*

Introduction

Sexual dysfunction among infertile women is an emerging area of study in Nigeria. Despite the availability of studies on sexual dysfunction among infertile women in developed countries [1,2,3], studies among Nigerian infertile women are few [4,5]. Infertility is a pandemic in Nigeria, with some studies showing some of the highest incidences in the hospital settings in Sub-Saharan Africa [6,7]. This being the case calls for an investigation into the sexual problems encountered by the infertile female population [7]. The culture of silence in sexuality-related issues due to adverse socio-cultural and religious practices in Africa means that many infertile women may be suffering in silence with nobody to voice out their frustration. The societal discrimination, divorce threats and general abuses, and domestic violence suffered by these women is likely to affect their sexual response. Hence, there is a clarion call for investigation into the extent of sexual dysfunction suffered by infertile women, identify modifiable risk factors to develop

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appropriate culturally sensitive and acceptable modalities of treating these women [5, 6].

A growing number of healthcare practitioners deal with sexual dysfunction in many patients with chronic illnesses. Infertile women are a cohort of people largely managed by gynaecologist either at public or private health care facilities. The gynaecologist is in a vantage position to help infertile women with sexual dysfunction since they are, by training, the best qualified to handle intricate sexuality problems. The quality of information given to these women and the manner in which it would be delivered is very critical in helping them cope with their sexual difficulty. This is particularly delicate because the central issue surrounding infertility revolves around sexuality and having a satisfying sexual life. Unfortunately, there is no published study from Nigeria on the extent to which gynaecologist screen infertile women for sexual dysfunction. It is important to fill this extant knowledge gap since Nigeria has no official protocol or national guideline for the management of sexual dysfunction. Even in developed countries, studies on gynaecologist approach in management of female sexual dysfunction are few [1, 8, 9, 10].

This study was conducted to evaluate the approaches gynaecologists in Osun East Senatorial district, Southwest Nigeria, uses to screen and manage their infertile women for sexual dysfunction. This is very important in view of the increasing evidence that sexual dysfunction may be a pertinent problem among infertile Nigerian women.

Materials and Methods

This is part of a larger study on prevalence, predictors. Pattern and management of female sexual dysfunction between infertile and fertile women in Osun East Senatorial District, Southwest, Nigeria being a PhD research thesis for the Award of PhD by the Texila America University/ the University of Central Nicaragua. This study was approved by the Ethics and Research Committee (ERC) of the Obafemi Awolowo University Teaching Hospitals Complex Ile-Ife, Nigeria (Protocol No: ERC/2019/12/14) and by Health Research Ethics Committee, Institute of Public Health, Obafemi Awolowo University, Ile-Ife, Nigeria (Protocol No: IHUOAU/12/1389) and it was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. Verbal informed consent was obtained from all the doctors before inclusion in this part of study.

This is a mix- method study incorporating quantitative aspects and qualitative aspects using an in-depth interview guide. In the quantitative aspect, a self-administered questionnaire was developed to investigate the screening practices employed by health workers (doctors) in assessing sexual dysfunction among infertile patients and strategies used in managing their patients' sexual issues. The questionnaires included sociodemographic characteristics of the doctors including age, marital status, religion, job description, years of experience. The second aspect explored the assessment of sexual functioning, when the assessment was usually done, frequency of assessment, ways of eliciting sexual functions, usual feeling with sexuality discussion with patients, the third section include their knowledge and use of standardized tools for assessment of sexual functioning of patients. The last section explored the treatment given to patients with sexual dysfunction.

In the qualitative aspect, an in-depth interview guide was used in gathering data about the experience in teaching undergraduate and postgraduate students on the topic of female sexual dysfunction. Information on their own training in female sexual dysfunction and the use of standardized sexual functioning tools in the routine teaching and services in the teaching hospital were also explored. The responses were triangulated with the results of the quantitative data. Data gathered from the questionnaires were appropriately sorted,

coded, and entered into the computer system using Statistical Package for Social Sciences (SPSS) version 22 and STATA 12.

Results

Table 1 showed the demographic characteristics of the forty participants. The Majority (85%) were males, the mean age is 40.95 years. Forty percent were aged 18-39 years, thirty percent were aged 40-49 years, and twenty-five percent were aged 50 and above. Fifty-five percent were married, while forty-five percent were single. Ninety percent were Christians. Professional cadre include Registrar (35 percent); Senior Registrar (32.5 percent) and Consultant (32.5 percent). Their years of experience include 3 years and below (20 percent), 4 to 5 years (45 percent), more than 6years (35 percent). Table 2 showed the screening practice for sexual dysfunction in patients by health care providers for patients. All forty doctors assess the sexual functioning of infertile patients. The Assessment was usually done at the first time of seeing the patient in all the patients. However, among five doctors the assessment also occurs when patients start discussing it or when a patient's complaint is directly related to it. Ways of eliciting sexual concerns among the clients include asking about on the frequency of sexual intercourse per week, asking about ejaculatory intercourse, asking about how satisfying the sexual intercourse has been and enquiring about sexual dyspareunia. They are all comfortable discussing sexuality issues.

Table 3 showed respondent's experience with the use of standardized tools in assessing sexual functions. Reasons for none use of standardized tools include among others include no tools available in the case file (100%), no training and skills in the use of standardized assessment tools (75%), not incorporated in the undergraduate and postgraduate training curriculum, not aware of any standardized tool, inadequate time (62.5%), patients' embarrassment (42.5%), it is a private matter (35%), lack of privacy and / or confidentiality (25%) and cultural limitations (10%). Table 4 showed the experience of treatment of female sexual dysfunction. Twenty (50%) of the doctors had treated a patient for female sexual dysfunction. Management strategies include behavioural modification (30%), psychotherapy (25%), treatment of other systemic illnesses (10%), and sex therapy (5%).

Discussion

The objective of this study was to evaluate how gynaecologist address the sexual problems of their infertile patients. This study clearly showed that sexual history taking by Nigerian gynaecologists during outpatient consultation of infertile women was grossly inadequate, unstructured and not systematic. There is no data in Nigeria or even in Africa in this area to the best of our knowledge. Studies investigating the specific content of the physician's sexual history taking or how physicians assess patients' sexual function worldwide are few. Studies on the influence of physician characteristics such as gender, age, race, sexual orientation, location of medical education, and type of practice on sexual history taking revealed contradicting findings [11, 12]. While some studies show female physicians are significantly more likely to discuss sexual activity with clients [12], others reported no significant association between gender and sexual history taking or screening for sexual dysfunction [11]. While a previous study showed, younger physicians are more likely to take sexual histories [13]. Another study found no significant association between physician age and asking about sexual activity [12] or screening patients for sexual dysfunction [11].

Our findings showed that the doctors were purely interested in asking about the frequency of sexual intercourse per week, presence of ejaculatory intercourse, satisfaction with sexual activity and about presence or absence of dyspareunia as they were taught during their undergraduate and postgraduate medical

training. There are also no differences in between consultants and residents in terms of age, duration of practice, gender in their pattern of assessment of female sexual dysfunction. Given that sexuality is a key section of women's physical and psychological health [14] and that the gynaecologist by the depth and specialization across specialties are better positioned to deal with sexual dysfunction, all efforts should be made to inculcate sexual assessment functioning in their training and the gynaecologist knowledge and competence base should be regularly updated. Improvements in medical training and further training courses are essential to improve the outpatient care of women with female sexual dysfunction [8].

The findings in this study contrast with that from Switzerland where up to 7.9% of gynaecologists ask about sexuality issues [1]. A higher prevalence of 40 % gynaecologist reported routinely exploring sexual problems at routine gynaecology unit [14]. In our study, the only domain of sexual function commonly inquired of by the gynaecologist is the presence or absence of dyspareunia. The common complaint of dyspareunia has been explained by the observation that patients prefer a somatic approach in which pain is an appropriate symptom to talk about with a physician [1]. Other symptoms such as lack of desire or arousal difficulties are considered to be too intimate or not ideal or appropriate to mention in a gynaecological consultation. As expected, all the doctors are comfortable discussing sexuality matters.

It is surprising that none of the doctors routinely use standardized sexual functioning assessment tools. The reasons given for non-use of these tools include, among others: no tools available in the case file (100%), no training and skills in the use of standardized assessment tools (75%), not incorporated in the undergraduate and postgraduate training curriculum, not aware of any standardized tool, inadequate time (62.5%), patients embarrassment (42.5%), it being assumed to be a private matter (35%), lack of privacy and/or confidentiality (25%) and cultural limitations (10%). The above reasons had also been reported by others [9], and it clearly showed that Nigerian doctors are poorly equipped to address sexuality health problems. Yet, the gynaecologists by their training are supposed to be expert in addressing the conditions of the female genital tract across the female life course [2, 14]. They are well-positioned among all other doctors to address sexuality issues with female patients and especially infertile women. Findings from in-depth interviews among all cadres of doctors showed that the poor assessment of sexual functions by the doctors is deep rooted in non-inclusion of these tools in the training curricula at undergraduate and postgraduate level of education.

The opinion of these doctors was sampled on the feasibility and desirability of including the assessment tools for sexual dysfunction in the patient's case file. While some supported it, some voiced out that it will be more time-consuming and increase waiting time for the patients which may discourage clinic attendance. It has been observed that the daily work lead in obstetrics and gynaecology does not permit time to develop a special focus on communication because the priority lies on medical or surgical interventions, Still, the fact remains that the patient gynaecologist communication is characterized by specific intimate topic with a high emotional impact and the gynaecologist must respond to these emotions and personal beliefs and values of their patients [15]. Not taking a detailed relevant, and focused sexual history from patients highlights many missed opportunities for counselling and treatment of sexual dysfunction. This is a clarion call for the inclusion of up-to-date guidelines on sexuality education, assessing sexual functions in all women in the curriculum of undergraduates, and postgraduate medical training [14].

Despite the obvious deficiencies revealed from the responses on in-depth interview, fifty

percent of the doctors stated that they had previously treated a patient with sexual dysfunction. Treatment modalities rendered included behavioural modifications, psychotherapy, treatment of other systemic illnesses, and sex therapy. However, how relevant and effective these treatments are need further evaluation.

Any discussion of sexuality in a gynaecology clinic is typically limited, mainly because of a lack of models or protocols available to guide the discussion of the topic. It has thus been suggested that the use of protocols may facilitate the discussion of sexual issues in gynecological settings. It has the potential to provide an effective approach to the complex aspects of sexual dysfunction in women. This study showed that patient's discussion of sexuality with doctors in Nigeria is limited because of several factors, which also had been confirmed by previous studies in other countries [2, 10, 16, 17, 18, 19, 20]. In a related study among German gynaecologists [8], it was reported that the gynaecologists did not regularly take a complete sexual history of their patients. They were mainly concerned with recognizing female sexual dysfunction and encouraging their patients to undergo treatment.

Conclusion

This study showed that consultants and residents in Obstetrics and Gynaecology department are poorly equipped to address sexual problems and sexual dysfunction among infertile women. It is imperative that the curricula of medical training be updated to include assessment of sexual functioning tools. In the interim it is suggested that models should be provided to guide a doctor in the discussion of sexual dysfunction.

Table 1. Socio-demographic Characteristics of Participants (N=40)

Variable	Frequency	Percentage
Sex		
Male	34	85
Female	6	15
Age(years)		
28-39	18	45
40-49	12	30
≥50	10	25
Marital status		
Single	18	45
Married	22	55
Religious		
Christianity	36	90
Islam	4	10
Professional Cadre		
Registrar	14	35.0
Senior registrar	13	32-5
Consultant	13	32.5
Years of experience		
3 and below	8	20.0
4-5	18	45.0
>6	14	35.0

Table 2. Screening Practice for Sexual Dysfunction in Patients by Health Care Providers for Patients

Screening Practices	Frequency	Percentage
Assessment of Sexual functioning n=40		
Yes	40	40.0
No	0	0.0
When assessment is usually done*		
First time of seeing the patient	40	100.0
When patient starts discussion about it	5	5.0
When patient's complaints are directly related to it	5	5.0
Ways of eliciting sexual concerns in patients*		
By asking about frequency of sexual intercourse per week	40	100.0
By asking about ejaculatory intercourse	40	100.0
By asking about how satisfying sexual activity has been	40	100.0
By asking about dyspareunia	40	100.0
Usual feeling with sexuality discussion with patients n=40		
Comfortable	40	100.0
Embarrassed	-	-
Uncomfortable	-	-

*Some gave multiple responses

Table 3. Use of Standardized Assessment Tools for Assessment of Sexual Dysfunction among Health Care Providers

Variable	Frequency	Percentage
Ever Use of Standardized Tools in assessing Sexual Functions		
Yes	0	0.0
No	40	100.0
Reasons for non-use of the standardized tools*		
No tool available in the case file	40	100.0
No training and skills in the use of standardized assessment tools	30	75.0
Not incorporated in undergraduate and postgraduate training curriculum	30	75.0
Not aware of any standardized tool	25	62.5
Inadequate time	25	62.5
Patient's embarrassment	17	42.5
It is a private matter	14	35.0
Lack of privacy and/or confidentiality	10	25.0
Cultural limitation	4	10.0

*Some gave multiple responses

Table 4. Treatment of Female Sexual Dysfunction

Variable	Frequency	Percentage
Treatment experience		
Ever treated FSD	20	50.0
Never treated FSD	20	50.0
Management strategy*		
Behavioural modification	12	30.0
Psychotherapy	10	25.0
Treat other systemic illnesses	8	20.0
Sex therapy	2	5.0

*Some gave multiple response

In-Depth Interview for Doctors

Consultants

An in-Depth Interview was Conducted on Consultants Gynaecoloigsts in the Institutions. Here were the Except:

Participants 1. A 54 – year old Consultants

It is when you brought up this topic that I just remembered that I have never taught students on this topic. As much as I could remember I was not taught this topic in my undergraduate and postgraduate residency period. I could only recollect faintly that I occasionally hear about such tools along the line once in a while at conference presentation or while reading some journals. I have never really read it or studied it in details.

Asked why he is not using it while Assessing Patients. Here is his Response

You cannot use what you are not knowledgeable about. More so the tools are not incorporated in patients case files. It will be difficult to enquire of such information routinely if the questionnaire is not readily available.

Asked about the Willingness to use the Tools if Incorporated into Patient's Case File. Here is his Response

I believe I will use it, but this means more time will be spent attending to one client and there are many patients waiting to be attended to. The patients would start complaining about longer waiting time and this may discourage them from accessing care in the teaching hospital.

Asked about Suggestions to enable the Incorporation of Female Sexual Functioning Tools into Routine Infertility Clinics. This is an Elaborate Suggestion given by a Senior Colleague

I understand there are many tools developed to assess female sexual functioning. It will be desirable to incorporate them in the undergraduate and postgraduate medical school curricula. This would make it easy for doctors to be versed in the knowledge and use of them. In addition, a uniform tool should be agreed upon and a protocol developed for the hospital use. This protocol should then be submitted to medical records to be incorporated into the case not.

Another Consultant -a 43-year-old Consultant made Further Suggestions

Incorporating the tools routinely into all gynaecology case files may not be economical. A separate multidisciplinary unit to handle patients with sexual dysfunction should be created Time has come when gynaecology department will take the issue of sub-specialization serious. It will be difficult to incorporate such with all gynaecology patients having other complaints such as uterovaginal prolapse, genital fistula, uterine fibroids,

gynaecology oncology cases, pelvic inflammatory diseases, endometriosis etc. The clinic would be boring and stressful not only to the doctors and nurses but also to the patients. I suggest that a separate infertility unit should be developed and devoted to all aspects of infertility. By so doing they will have enough time to go into details on sexual functioning. We should not forget that sexuality is a multidisciplinary issue which involve the gynaecologist, the psychologist, sex therapist, social workers, and specially trained nurses.

Senior Registrars

A Senior Registrar I have this to say

We were not taught about sexual dysfunction in our undergraduate and postgraduate education. I cannot mention any screening tools for sexual function screening. This study just aroused my interest to browse and study management of sexual dysfunction. It will be good if the tool is incorporated into our infertility case file but this means more time to spend with patients during the clinics.

A Female Senior Registrar I have this to say:

I don't have any knowledge of definition and classification of sexual dysfunction. I know that men and women can have sexual difficulties but to I have not studied it in an organized topic as sexual dysfunction. I always ask questions about presence or absence of pain or satisfaction about sexual intercourse but I don't know it as component of sexual dysfunction. It will be good if that can be introduced in our training curriculum.

Acknowledgement

The authors thank the management of Obafemi Awolowo University Ile-Ife for the award and release of 2013 needs Assessment Academic Staff Training and Development (AST &D) Fund to complete a PhD course in Medicine at the Texila American University. This article was published from the data extracted from the PhD research thesis. We thank Ms. Anjuna C, my Student Mentor, for her continuous encouragement, corrections, and instructions during this entire research work. I also appreciate my co-guide, Professor Ogunjuyigbe, for his untiring encouragement. I also appreciate the respondents interviewed in this study and my colleagues for granting me assess to use their patients.

Conflict of Interest

The authors declare no conflict of interests. This work is purely done and published from the PhD research thesis.

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Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.08.02.Art007

Atherosclerotic Cardiovascular Disease Risk Among Patients with Type 2 Diabetes in Uganda

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Abstract

While atherosclerotic cardiovascular disease risk is increased in patients with type 2 diabetes, the magnitude and socio-demographic determinants of this risk are not known in Uganda. We aimed to establish the magnitude of the predicted 10-year atherosclerotic cardiovascular risk and describe its socio-demographic determinants among patients with type 2 diabetes in Uganda. This was a cross-sectional study conducted in eight (8) diabetes clinics from November 2020 to February 2021. We enrolled 500 patients with type 2 diabetes aged between 40 to 79 years. Patients were interviewed on their socio-demographic characteristics. Anthropometric and laboratory measurements were performed. The predicted 10-year atherosclerotic cardiovascular risk was categorized using the Pooled Cohorts Risks Equations. Bivariate and multivariate logistic regression was conducted to establish associated socio-demographic factors. The majority of participants were females (78%), with a mean age of 55.14years (SD±8.96). Of the patients studied, 20% were at low risk (score <5%), 14.2% borderline risk (score 5-≤7.5%), 45.2% intermediate risk (score7.5-<20) and 20.6% high risk (score ≥20%). Elevated risk of score ≥7.5% was found in 65.8%. The male gender (AOR= 5.456, 95% CI 2.998-9.932, p=0.001), at least 50 years of age (AOR=7.841 95% CI 4.863-12.642, p=0.001), part-time employment (AOR=1.726, 95% CI 1.221-2.441, p=0.002) and being widowed (AOR=2.4, 95% CI 1.192-4.833, p=0.002) were significantly associated with cardiovascular disease risk. The cardiovascular disease risk among patients with type 2 diabetes is high. The male gender, age of at least 50years, part-time employment, and being widowed are socio-demographic factors that should be prioritized at primary level management of cardiovascular disease.

Keywords: *Atherosclerotic cardiovascular risk, Diabetes mellitus, Uganda.*

Introduction

Atherosclerotic cardiovascular disease causes immense morbidity and mortality among patients with type 2 diabetes. Diabetic patients are at a two-to-four-fold increase in atherosclerotic cardiovascular disease risk compared with non-diabetic individuals [1]. Among diabetic patients, the atherosclerotic cardiovascular disease contributes to more than 75% of the overall cause of deaths [2].

For long, diabetes has been regarded as Cardiovascular disease (CVD) risk equivalent,

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and this was first suggested by Haffner and colleagues as patients with diabetes without prior myocardial infarction had a similar risk of coronary heart disease to those without diabetes with myocardial infarction (Haffner). This observational study in a Finnish population cohort underlies the suggestion that all people with diabetes should be treated as if they had existing coronary heart disease (CHD). This has since been challenged as this study lacked the power to detect differences between groups of patients. Additionally, patients in this Finish study were self-selected rather than obtained from a population-based cohort [3].

Moreover, a meta-analysis [4] did not show diabetes as a coronary heart disease equivalent and decisions to treat diabetic patients for primary CHD prevention should be based on patient's CHD risk estimate other than "one coat fits all" approach of treatment [4].

A population-based prospective cohort analysis where 1,586,061 adults aged 30-90 years were compared for the risk of subsequent CHD events among individuals with or without a history of diabetes or CHD in a large contemporary real-world cohort over a period of 10 years showed that the risk of future CHD for patients with a history of either diabetes or CHD was similar only among those with diabetes of long duration≥ 10 years [5].

Hence, the atherosclerotic cardiovascular disease (ASCVD) risk is no longer universal for all diabetic patients as there is now heterogeneity in this risk among the diabetic population most especially those younger than 40 years and those with recent onset of the condition [6].

In asymptomatic diabetic patients, there is need to screen for the ASCVD risk as early identification and stratification leads to appropriate management in both the long and short term [7].

Furthermore, quantification of ASCVD risk among diabetic patients is beneficial as it helps to rank patients according to absolute risk for the purpose of aiming therapy to those at greatest risk to fittingly apportion community and health resources.

Additionally, primary prevention modalities such as lipid-lowering therapy, blood pressure control, and antiplatelet therapy have been shown to be effective if used in appropriate patients [8]. Choosing these strategies is dependent on the determination of atherosclerotic cardiovascular risk.

The few diabetic patients in Uganda that are put on appropriate statin doses are those who have suffered from cardiovascular events. However, there is still lack of guidance on the appropriate statin dose for asymptomatic patients and with a short duration of diabetes.

With lack of local data on the predicted 10-year ASCVD risk, it is not clear when to intensify risk reduction strategies through use of newer drugs such as such as Sodium Glucose Co Transporter 2 inhibitors (SGLT2) or Glucagon like peptide 1 agonists (GLP-IA) that have demonstrated cardiovascular benefit in patients with high ASCVD risk or who have had Cardiovascular events [6].

Therefore, this study was conducted to provide data on the magnitude of the predicted 10- year atherosclerotic cardiovascular risk and its socio-demographic determinants among type 2 diabetic patients in Uganda to help guide appropriate early primary ASCVD prevention.

Materials and Methods

Study Design and Setting

This was a cross-sectional study that was conducted in eight (8) diabetes clinics in Central Uganda that referred most patients with cardiovascular disease to Mengo hospital in the preceding year.

Eligible diabetic patients were recruited from Entebbe grade B hospital, Mengo Hospital, Naguru Hospital, Kasangati Health Center IV, which are urban health facilities, and Wakiso Health Center IV, Mpigi Health Center IV, Mityana Hospital, and Kawolo Hospital, which are peri-urban health facilities. These facilities

run a weekly diabetes clinic where approximately 120 patients are treated.

Approximately 600 patients with type 2 diabetes attend these clinics per week. The facilities have well-organized manual patients registers. The diabetes clinics are run by medical officers, clinical officers, and nurses with varied knowledge and skills in diabetes and atherosclerotic cardiovascular disease care. The facilities were selected from both urban and peri-urban areas to enable comparison of predisposition to ASCVD hence generalizability of results. Additionally, the majority of patients with diabetes-related vascular complications that are referred to Mengo Hospital and Mulago hospitals come from Kampala, Wakiso, Mityana, Buikwe, Mpigi, and Mukono districts where these facilities are.

The study period was from November 2020 to February 2021.

Study Population

Patients with type 2 diabetics aged 40-79 years were eligible for the study if they consented and were asymptomatic for ASCVD. The revised Pooled Cohort Risks Equations used in this study are only validated among individuals aged 40 to 79 years. The Pooled Cohorts Risks Equations were used to quantify the ASCVD risk. Pregnant women and very sick patients were excluded from the study.

The sample size was calculated based on a cross-sectional survey using the formula [9]. Using the Uganda National Baseline survey data, the prevalence of the cardiovascular disease among type 2 diabetes was 40% compared to those without type 2 diabetes [10]. Basing on this data, the calculated sample size was 369. Due to the anticipated non-response rate for this study [11], the sample size was increased by 30%. Furthermore, 20 patients were added to adjust for the loss to follow up. Thus, the total sample size was 500 patients with sixty-three (63) patients from each of the eight [8] health facilities. The patients were selected consecutively from the diabetes registers. Trained Research Assistants educated them about the study. Written Informed Consent was obtained from the patients.

Socio-Demographic and Anthropometric Data Collection

Socio-demographic data such as age, sex, residency, employment status, level of education, marital status, family history of coronary heart disease, history of sudden cardiac death, alcohol, and smoking history were collected using a data collection form by the study nurses.

Anthropometric measurements such as blood pressure, weight, height, body mass index, waist circumference, hip circumference, and waist-hip ratio were taken.

Blood pressure was measured by study nurses using an automated OMRON® digital blood pressure machine with an appropriate cuff size. The cuff was placed on the upper arm so that the bladder of the cuff would be centered over the brachial artery. The readings were taken 5 minutes apart following 15 minutes of rest. Three measurements were taken, and an average of these was documented as the participant's blood pressure. Participants were refrained from talking, eating, or smoking for at least 30 minutes before the blood pressure measurements.

Hypertension was defined as systolic blood pressure (SBP)≥140mmHg and or diastolic blood pressure (DBP) ≥90mmHg as per the US 7th Joint National Committee on detection, evaluation, and treatment of hypertension [12].

Weight was measured to the nearest 0.1kg, with the subject standing motionless on the weighing scale. Each weighing scale was standardized every day with a weight of 50 kg. Participants were asked to remove slippers or shoes and any other articles of heavy clothing or jewelry. Participants were asked to step onto the scale in the middle of the platform with their heads erect and eyes looking straight in order to evenly distribute their weight.

Height was measured with the participant standing in an erect position using a portable stadiometer. Participants were checked to ensure the heels, buttocks, shoulder blades, and the back of the head are in contact with the vertical backboard.

The participants head was aligned in the Frankfort horizontal plane (the horizontal line from the ear canal to the lower border of the orbit of the eye is parallel to the floor and perpendicular to the vertical backboard. Arms were made to hang free at the sides with palms facing the thighs. The study nurses' eyes would be level with the headboard. As the headboard was lowered, the participant was instructed to take a deep breath and hold that position while the horizontal board was brought down firmly on top of the head. The headboard was held firmly on top of the head with sufficient pressure to compress the hair. The measurement was recorded to the nearest 0.1cm.

Body Mass Index

Body Mass Index was calculated as weight in kilogram divided by squared height in meters. Conventional BMI cut-offs were used to classify the study population into underweight (BMI <18.5 Kg/m^2) normal BMI (≥18.5 <25 Kg/m^2 overweight BMI >25 to <30 Kg/m^2) obese > 30 Kg/m^2.

Waist Circumference

Participants were instructed to unclothe their waist and hips and stand with their feet pointing forwards and approximately 25-30cm apart to distribute their weight evenly. The lower rib margin was felt, and a marker with a non-permanent marker was made at the exact level of the lowest rib margin. The iliac crest was palpated in the midaxillary line and make a mark on the skin surface. The distance between the two marks (rib cage and iliac crest) was measured. The Participant was instructed to breathe out gently while measurement was taken. A non-stretchable measuring tape was applied horizontally around the participant's body to take the measurements in centimeters. The waist circumference was measured twice to the nearest centimeter using a non-stretchable measuring tape, and the mean values were recorded in the data collection forms. Elevated waist circumference was defined as ≥102cm for men and ≥88cm for women.

Hip Circumference

Study nurses measured the hip circumference using a non-stretchable measuring tape applied at the widest portion of the buttocks at the level of the greater trochanters. The measurements were recorded in centimeters in the participant's data collection form.

Waist-Hip Ratio

The participant's average waist circumference was divided by the average hip circumference to obtain the waist-hip ratio. Elevated waist-hip ratio was defined as ≥0.95 for men and ≥0.88 for women.

Laboratory Data Collection

After 12-hour fasting, blood samples were aseptically collected on the day of appointment by venipuncture of the brachial vein in a 5ml EDTA tube and a 5ml plain tube. Samples were placed on ice(4^0c) and immediately transported to the biochemistry laboratory at Mengo Hospital, where plasma and serum specimen was separated by centrifugation at 3000r/min for immediate analyses. Standard calorimetric methods were used to assay fasting plasma glucose, total cholesterol (TC), triglycerides (TG), and high-density lipoprotein cholesterol (HDL-C). Low-density lipoprotein cholesterol (LDLC) was calculated using the Friedwald formula when TG levels are equal to or less than 4mmol/l. Standard colorimetric procedures were used to directly measure LDL-c when TGs are >4mmol/l.

Low-density lipoprotein cholesterol and very low-density lipoprotein were determined as follows using the Friedwald formula:

VLDL=TG ÷ 5

LDL-C=(TC)-VLDL(TG/5) +HDL

Total cholesterol and high-density cholesterol values were fed into the revised Pooled Cohorts Risk Equation to calculate the predicted 10–year atherosclerotic cardiovascular risk.

Quantification of the Predicted 10-year Atherosclerotic Cardiovascular (ASCVD) Risk

Ten-year risk is defined as the risk of developing a first ASCVD event, defined as non-fatal myocardial infarction, fatal or non-fatal stroke over 10-year period among people free from ASCVD at the beginning of that period [13]. The revised Pooled Cohort Risk Equations [14] were used in this study to assess quantitively the atherosclerotic cardiovascular risk among participants with type 2 diabetes aged between 40 and 79 years.

The following independent variables, namely; sex, age, race, total cholesterol, high-density cholesterol, systolic blood pressure, treatment for high blood pressure, presence of diabetes condition, smoking status, were fed into the online Pooled Cohort Risk calculator to calculate the 10-year ASCVD risk. The scores were categorized as low risk with a score < 5%, borderline risk 5-≤7.5%, intermediate risk 7.5-<20% and high risk ≥20% [15]. The risk score was further categorized into a score of less than 7.5 and ≥7.5 % (elevated risk) which is regarded as the clinically relevant threshold [16].

Statistical Analysis

Continuous variables were described using the mean and standard deviation. The ASCVD risk scores were categorized, and their proportions and percentages were calculated with their confidence intervals of 95% (95% CI). The Proportion and percentages of the risk categories were used to obtain the magnitude of the ASCVD risk. The socio-demographic variables were described in terms of proportions, mean and standard deviation. Bivariate and multivariate analyses were done using logistic regression. While adjusting for clustering at health study site levels. The backward method was used to drop the most insignificant variables and to assess for interaction.

There were no significant interactions of the covariables. Confounding was assessed by at least 10% change in the crude and adjusted odds ratios. Statistical significance was set at a p-value of < 0.05.

Ethical Consideration

The study was approved by the Mengo Hospital Research and Ethics committee and registered by the Uganda National Council of Science and Technology. Written informed consent was taken from all study participant results.

Results

Socio-Demographic Characteristics

A total of 500 participants between the ages of 40 and 79 years were screened for the 10-year predicted atherosclerotic cardiovascular risk. Out of 500 participants, 387 (77.4%) were female and 113 (22.6%) were male. The mean age for female and male participants was 55.14 (sd±8.96) and 54.86 (sd±9.07) respectively. These are summarized in Table 1.

Moreover, more than a third of the participants, 141 (36.25%), were in the age range of 50-59 years.

Most of the participants, 323 (64.6%), lived in peri-urban/urban areas, and the majority were unemployed 195 (39%). More than half of the participants, 51.21% (n=256), were educated up to primary school level. No school attendance was noted among 7.6% (n=38) of the participants. The majority of the participants, 57% (n=285), were married. More than eighty percent (80%) of the study participants did not have a family history of coronary heart disease and premature coronary heart disease death. Only 6.8% (n=34) of the participants take alcohol. Smoking was reported among 0.2% (n=1) of the participants.

Table 1. Baseline Socio-Demographic Characteristics of Study Participants(N=500)

Variable		**n (%)**
Sex	Female	387(77.4)
	Male	113(22.6)
Age	40 - 49	144(28.8)
	50 - 59	187(37.4)
	60-69	133(26.6)
	> 70	36(7.2)
Residence	Urban	323(64.6)
	Rural	177(35.4)
Body Mass Index	Under weight	2(0.4)
	Normal	103(20.6)
	Over weight	179(35.8)
	Obese	216(43.2)
Level of education	None	38(7.6)
	Primary	256(51.2)
	Secondary	151(30.2)
	Tertiary	55(11.0)
Marital status	Single	114(22.8)
	Married	285(57.0)
	Widowed	80(16.0)
	Separated	21(4.2)
Employment status	Full time employment	131(26.2)
	Part time employment	24(4.8)
	Causal employment	70(14.0)
	Unemployment	195(39.0)
	House wife	80(16.0)
Family history of CHD	Yes	73(14.6)
	No	427(85.4)
Familial history of premature CHD death	Yes	36(7.2)
	No	442(88.4)
	Don't know	22(4.4)
History of hypertension	Yes	360(72.0)
	No	134(26.8)
	Don’t know	6(1.2)
Alcohol status	Yes	34(6.8)
	No	448(89.6)
	Quit	18(3.6)
Smoking status	Yes	1(0.2)
	No	491(98.2)
	Quit	8(1.6)
CHD Coronary Heart Disease, SD - standard deviation		

Anthropometric and Laboratory Measurements

The participants were majorly overweight 35.8% (n=179) and obese 43.2% (n=216) with a mean BMI of 27.83Kg/m (SD ±5.77). The female participants had a higher waist circumference, 37.8% (n=189), compared to male participants, 2.2% (n=11). Correspondingly, women had a higher waist-hip ratio 46.6% (n=233) than men 10.2% (n=51). The mean systolic blood pressure for participants was 137.5 (SD±1.658). The majority, 58% (n=290) of participants, had elevated total cholesterol. Most 68.4%(n=342) of the female participants had normal high-density lipoprotein cholesterol. More than half of the participants, 55.8 (n=279), had elevated triglyceride levels. Elevated low-density cholesterol (LDL) was found in more than three-quarters (78.6%) of the participants, and the mean LDL was 3.502mmo/l (SD±1.246). Details of anthropometric and laboratory measurements are shown in Table 2.

Table 2. Anthropometric and Laboratory Measurements of Study Participants(N=500)

Variable		**n (%)**	**Mean(±SD)**
BMI	Underweight<18Kg/m^2)	1(0.26)	
	Normal (18-24.99Kg/m^2)	104(20.8)	
	Overweight (25-29.99Kg/m^2)	179(35.8)	
	Obese (≥30Kg/m^2)	216(43.2)	
Mean BMI			27.83Kg/m^2±5.77
WC			
Females	<87.99cm	200(40)	
	≥88cm	189(37.8)	
Males	<101.99cm	100(20)	
	≥102cm	11(2.2)	
Mean WC			88.46cm±12.46
WHR			
Females	<0.879cm	156(31.2)	
	≥0.88cm	233(46.6)	
Males	<0.949cm	60(12)	
	≥0.95cm	51(10.2)	
Mean WHR			0.90±0.093
SBP	<140mmhg	289(57.8)	
	≥140mmhg	211(42.2)	
Mean SBP			137.5mmhg±1.65
DBP	<90mmhg	342(68.4)	
	≥90mmhg	158(31.6)	
Mean DBP			85.62mmhg±11.28
TC	<5.129mmol/l	210(42)	
	≥5.130mmol/l	290(58)	
Mean TC			5.405mmol/l±1.319
HDL-c			
Females	≥1.3mmol/l	342(68.4)	
	<1.299mmol/l	47(9.4)	
Males	≥1.0mmol/l	87(17.4)	

	<1.0mmol/l	24(4.8)	
Mean HDL-c			1.331mmol/l±0.372
TGs	<1.679mmol/l	221(44.2)	
	≥1.680mmol/l	279(55.8)	
Mean TG			2.0781mmol/l±.246
LDL-c	<2.559mmo/l	107(21.4)	
	≥2.56mmol/l	393(78.6)	
Mean LDL-c			3.502mmol/l±1.246

BMI=Body Mass Index, SD=Standard Deviation, Waist Circumference=Waist Hip Ratio, SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure=Total Cholesterol-c=High Density Lipoprotein cholesterol, TG=Triglycerides, LDL-c=Low Density Lipoprotein cholesterol

Magnitude of the Predicted 10-year Atherosclerotic Cardiovascular Disease Risk

The mean predicted 10-year atherosclerotic cardiovascular score was 13.4%(sd±9.9). Figure 1 summarizes the categories of the ASCVD risk. Of all the study participants,100(20%) was at low risk,71(14.2%) was borderline,226(45.2%) were intermediate risk, and 103(20.6%) were high risk.

Both the intermediate and high-risk categories constituted the elevated risk (score ≥7.5%), and this was found among 329 (65.8%) participants as shown in Figure 2.

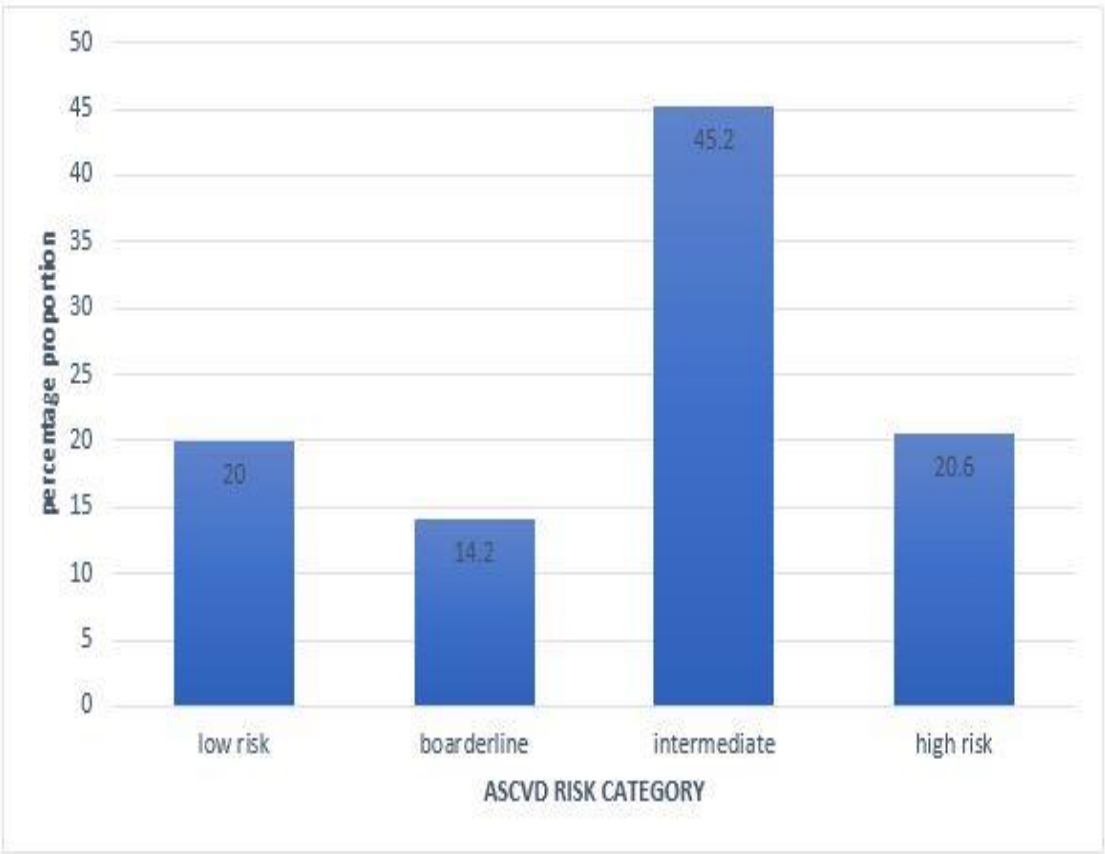

Figure 1. Atherosclerotic Cardiovascular Disease Risk Categories for Study Participants

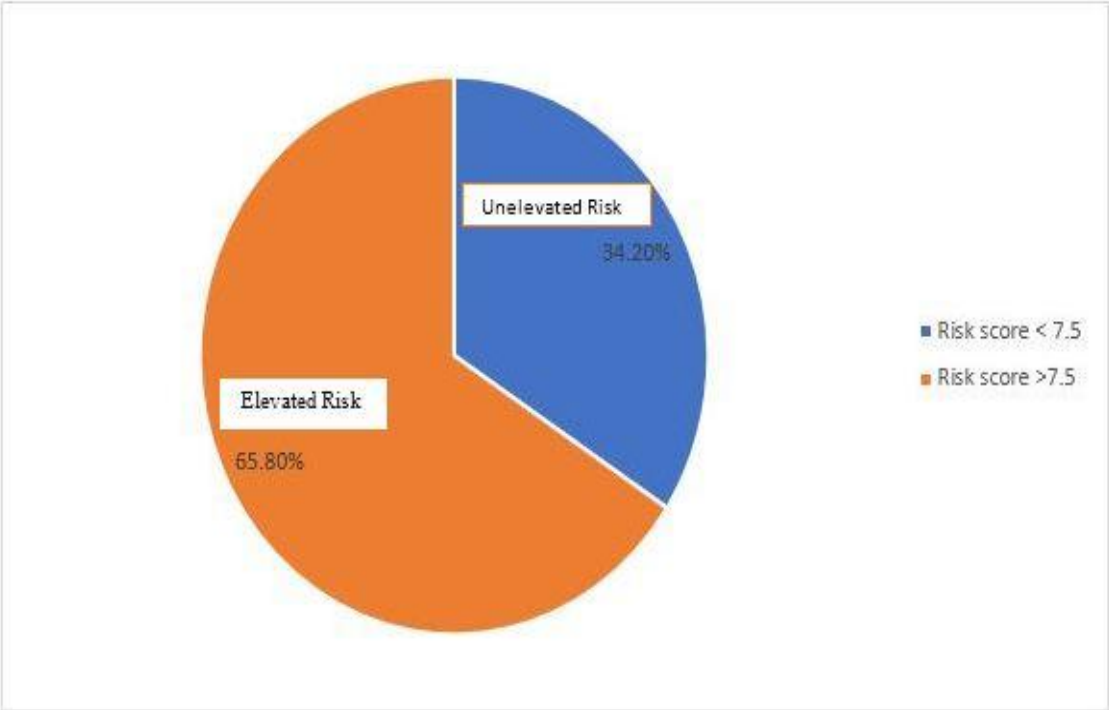

Figure 2. Study Participants with Elevated and Unelevated Atherosclerotic Cardiovascular Risk

Atherosclerotic Cardiovascular Disease Risk Across Socio-Demographic Characteristics

The male participants 81.08% (n=90) were at elevated ASCVD risk than female participants 61.44% (n=239). The proportions of participants with elevated risk progressively rose above 50 years. The participants who lived in rural areas had more elevated risk, 71.19% (n=126), than those in the urban areas, 62.85%(n=203). Elevated ASCVD risk was highest among participants with no Employment, 77.95% (n=152). The distribution of both the low and elevated risk categories were similar across all education levels. Participants who were widowed were at the highest ASCVD risk, 86.25% (n=69). Family history of coronary heart disease (CHD) conferred a higher risk, 72.6% (n=53) compared to those without 64.6% (n=276). The participants with a family of CHD had a similar elevated risk, 63.89 (n=23) compared to those without 65.61 (n=290). The proportions of the elevated risk were similar among smokers 65.99%(n=324) and those who quit 62.5%(n=5). Elevated risk was highest among those who quit alcohol at 77.78(n=14). Details are shown in Table 3.

Table 3. Magnitude of Atherosclerotic Cardiovascular Risk by Socio-Demographic Characteristics(N=500)

Variable	**ASCVD score**		***p* value**
	Low risk n (%)	**Elevated risk n (%)**	
Sex			
Female	150(38.56)	239(61.44)	<0.001
Male	21(18.92)	90(81.08)	
Age			
40 - 49	23(85.19)	4(14.81)	<0.001
50 - 59	144(47.37)	160(52.63)	
60 - 69	3(2.26)	130(97.74)	
> 70	1(2.78)	35(97.22)	

Residence			
Urban	120(37.15)	203(62.85)	0.06
Rural	51(28.81)	126(71.19)	
Employment level			
Full time	58(44.27)	73(55.73)	<0.001
Part time	10(41.67)	14(58.33)	
Casual	26(37.14)	44(62.86)	
None	43(22.05)	152(77.95)	
House wife	34(42.5)	46(57.5)	
Education level			
None	15(39.47)	23(60.53)	0.851
Primary	87(33.98)	169(66.02)	
Secondary	49(32.45)	102(67.55)	
Tertiary	20(36.36)	35(63.64)	
Marital status			
Single	45(39.47)	69(60.53)	<0.001
Married	109(38.25)	176(61.75)	
Widowed	11(13.75)	69(86.25)	
Separated	6(28.57)	15(71.43)	
Family history of CHD			
Yes	20(27.4)	53(72.6)	0.185
No	151(35.36)	276(64.64)	
Family history of CHD death			
Yes	13(36.11)	23(63.89)	0.765
No	152(34.39)	290(65.61)	
Don't know	6(27.27)	16(72.73)	
Smoking			
Yes	1(100)	0(0)	0.373
No	167(34.01)	324(65.99)	
Quit	3(37.5)	5(62.5)	
Alcohol			
Yes	14(41.18)	20(58.82)	0.39
No	153(34.15)	295(65.85)	
Quit	4(22.22)	14(77.78)	

Socio-Demographic Factors associated with the Predicted 10 year-ASCVD risk

The following factors were significantly associated with ASCVD risk; male gender AOR 5.456(CI 2.998-9.932, p<0.001), age 50years and above AOR 7.841(CI 4.863-12.642, p<0.001), part-time employment AOR1.726(CI 1.221-2.441, p<0.002) and being widowed AOR 2.4 (CI 1.192-4.833, p<0.002).

Table 4 shows socio-demographic factors that were significantly associated with ASCVD risk on multivariate analysis.

Table 4. Unadjusted and Adjusted Odds Ratios for the Socio-demographic Factors Associated with Atherosclerotic Cardiovascular Disease Risk

Variable	Unadjusted Odds Ratios (95% CI)	P-value	Adjusted Odds Ratios (95% CI)	P-value
Sex				
Female	1		1	
Male	2.661(2.135-3.317)	<0.001	5.456(2.998-9.932)	<0.001
Age- group				
40-49	1		1	
50-59	7.675(5.546-10.775)	<0.001	7.841(4.863-12.642)	<0.001
60-69	158.73(70.4-357.88)	<0.001	161.442(73.059-356.748)	<0.001
70&above	119.44((14.299-998	<0.001	103.2(11.2-946	<0.001
Employment Status				
Full time	1		1	
Part-time employment	1.130(0.441-2.892)	0.799	1.726(1.221-2.441)	0.002
Casual employment	1.356(0.896-2.051)	0.149	1.186(0.552-2.547)	0.662
Unemployed	2.807(1.249-5.436)	0.002	1.235(0.701-4.296)	0.233
House wife	1.065(0.46-2.462)	0,883	1.486(0.512-4.312)	0.466
Marital Status				
Single	1		1	
Married	1.149(0.795-1.661)	0.459	1.05(0.788-1.399)	0.741
Widowed	4.894(2.45-9.772)	<0.001	2.4(1.192-4.833)	0.014
Separated	2.033(0.929-4.493)	0.079	2.052(0.709-5.949)	0.185

Discussion

This study has revealed that most patients (45.2%) belonged to the intermediate-risk category. Further distribution of the risk was 20% in the low risk, 14.2% in the borderline, and 20.6% in the high-risk categories. Our findings underpin the heterogeneity of the ASCVD risk among patients with type 2 diabetes(4). Patients with diabetes in Uganda are universally treated for coronary artery disease since there is a paucity of data to guide primary prevention and management of this condition. This leads to indiscriminate use of the meagre resources available in a poor country facing a double burden of communicable and non-communicable diseases.

Since our study shows that not all patients are at the same ASCVD risk, there should be a varied approach in their management as regard to statin dose intensity, antiplatelet therapy, and choice of anti-diabetic agents. Without ASCVD stratification, diabetic patients are either under or over-treated [17]. Therefore, in Uganda where there is a high prevalence of dyslipidemia (88%) among patients with diabetes and low rates of its screening, and limited use of lipid-lowering drugs [18]. It is important to educate health workers on the utility of ASCVD risk stratification and management in a poor resource setting. A number of International guidelines such as the 2013 American College of Cardiologists (ACC)/ American Heart Association (AHA),2018 American Diabetes Association (ADA) standards of care, Brazilian Diabetes Society, and the 2016 European Society of Cardiology (ESC) no longer regard diabetes as coronary risk equivalent [19]. Therefore, the 2013ACC/AHA guidelines stipulate stratification for patients with diabetes aged 40 to 79 years into risk categories using a

global risk calculator, the Pooled Cohorts Risks Equations [19].

We have shown that the male gender, age of at least 50years, part-time employment, and being widowed are the socio-demographic determinants of a high ASCVD risk.

Basing on our findings, programs aimed at the control and management of ASCVD among patients with type 2 diabetes should prioritize; the male patients, those aged at least 50 years, the widowed, and those with part-time employment.

The heterogeneity of the ASCVD risk was also demonstrated in a study done in Qatar [20] to estimate the total 10-year cardiovascular disease risk using General Framingham Risk Prediction score and World Health Organization (WHO)/International Society for Hypertension (ISH), the WH0/ISH categorized 81.6% diabetic patients as low risk and 3.8% as high and very high risk while the Framingham score categorized 12.2% as low risk and 57.6% as high and very high risk. This study further confirms that not all diabetic patients are at the same ASCVD risk. Both our study and the Qatari study were of the same design and sample size, but there was a difference in the risk calculators used and, therefore, the difference in the risk categories and scores. We used a revised Pooled Cohort Risk Equations while [20] used WH0/ISH and the Framingham scores, but none of these calculators is specific for diabetic patients; they have a useful discriminative power although they tend to overestimate cardiovascular disease risk in diabetic patients, nonetheless, this does not preclude their usefulness in patients with diabetes [21].

Another study in the Middle East [22] also used general Framingham risk profile and the joint WH0/ISH risk calculator in Omani and showed that between 44% (WHO/ISH charts) and 74% (GFRP method) of patients with DM are at significant high risk for cardiovascular events (≥20% over 10 years).In contrast to the Omani study, our study had only 20.6% in the high-risk category, i.e. a score ≥ 20%, and this difference could be explained by the different study designs and risk calculators employed in both studies. The essence of atherosclerotic cardiovascular disease risk stratification is to implement primary prevention strategies in a cost-effective way, most especially in low resource settings.

In India, a study done to assess global CVD risk showed 68.8%,57%, and 0% in the high, moderate, and low-risk categories, respectively, with QRISK2 Risk Score and 67.7%,23.9%, and 3.2% in the high, moderate, and low-risk categories respectively with the Conventional risk score [23]. This study further shows that the CVD risk is heterogenous; again, the risk outcomes are different from our study as the risk calculators are different. The calculator we used was a revised version to reduce overestimation of the risk by the original version [13]. In a study done in Nigeria where the 10-years CVD risk was assessed with the Framingham score, among participants with type 2 diabetes, metabolic syndrome, and normal controls; low risk (score <10) was found in 27.5% diabetics,55% of metabolic syndrome patients and 72.5% normal controls [24]. The high risk (score>20%) was obtained in 52.5% diabetics,7.5% metabolic syndrome and 2.5% controls. This study had similar scores in the low-risk category and higher scores in the high-risk category compared to our study because the risk scores used were different, and our study had a larger sample size than the Nigerian study.

A Kenyan study done [25] examining the prevalence and correlates of metabolic syndrome and comparing 10-year cardiovascular disease (CVD) risk among Kenyan adults with and without HIV infection. The median ASCVD risk score was lower among people living with HIV compared to HIV negative participants (1.7% vs 3.0%, p=0.02). This study had lower scores compared to our study; participants in the Kenyan study were younger with a median age of 45 years (IQR39.5,53) and 40 years (IQR 31,55) for the People Living with HIV (PLWHIV) and HIV negative participants

respectively. Participants in our study were older, with a mean age of 55.14 (sd±8.96) females and 54.86 (sd±9.07) males. Additionally, there was a difference in the eligibility criteria, and the Kenyan study mainly enrolled people living with HIV with only 1.7% diabetics, while participants in our study were all diabetics. Human immunodeficiency virus (HIV) and diabetes may portend different ASCVD risks. The difference in the eligibility criteria could explain the difference. In a Ugandan Study looking at metabolic and renal complications, clinical and virologic outcomes among HIV positive Ugandan adults on long-term ant-retroviral therapy, 10-year ASCVD risk was assessed using Framingham risk score,16.6% of participants had a score above 10%. The difference in the score can be explained by the difference in the risk calculators and the study populations.

In the current study, male gender was significantly associated with ASCVD risk. This is consistent with a study done [20] where more males were in the high and very high-risk categories with both the General Framingham Risk Predictor (GFRP) and World Health Organization (WHO)/International Society of Hypertension (ISH)risk prediction charts [20, 22]. Similar findings were also found in India [23]. It is well documented that males are at more risk for CVD than females in the premenopausal period(6); in our study, there was no gender difference in mean age; females 55.14(sd±8.96) and males 54.86 (sd±9.07) thus, we would expect the risk difference to even out as women were post-menopausal. Menopause has been shown to increase cardiovascular risk [6]. The difference in our study findings could be explained by higher systolic blood pressure(p=0.008), higher diastolic blood pressure(p=0.109) and abnormal HDL(p=0.005) among males compared to females.

We report that age above 50 years progressively increased ASCVD risk. Our study underpins the relationship between age progression and increases in CVD risk that is directly related to age-dependent changes in the cardio-vasculature. Age is a major non-modifiable risk factor for CVD. The transition from low to moderate risk category occurs at 35 years and 45 years men and women respectively [6]. In our study, the mean age for men was 54.86 (sd±9.07), which transitioned them from low to higher risk categories. Our findings are similar to a study where cardiovascular risk was estimated with a pooled cohort Risk Equations among patients hospitalized in the internal medicine wards [26]. In this study, age greater or equal to 60 years was the main risk factor for high CVD risk.

Part-time employment was significantly associated with high ASCVD risk. Part-time employment is closely linked with job instability and periods of unemployment, all of which led to psychosocial stress [27]. Job instability and unemployment portend a low social, economic status which is associated with increased cardiovascular disease risk through psychobiological pathways that specifically slow recovery in blood pressure and heart rate variability following mental stress [28]. Our findings add to the evidence consistent with a study done among Whitehall II cohort of 228 British Civil servants aged between 47-58 years where the grade of employment (indicator of socio- economic status) was assessed against cardiovascular measures that were monitored during performance of two behavioral tasks and for 45 min following stress [28]. Post-stress return of blood pressure and heart rate variability to resting levels was less complete after 45 min in the medium and low than in the high-grade of employment groups. Furthermore, the odds of failure to return to baseline by 45 min in the low relative to the high grade of employment groups were 2·60 (95% CI 1·20–5·65) and 3·85 (1·48–10·0) for systolic and diastolic pressure, respectively, and 5·19 (1·88–18·6) for heart rate variability, adjusted for sex, age, baseline levels and reactions to tasks. We appreciate the significant difference between the British study

and ours but its findings are worth noting to explain this important association in our study.

Additionally, job instability and unemployment lead to unnecessary drug discontinuation, which is an independent determinant of cardiovascular disease among patients with diabetes [7]. In a population-based cohort study examining the association between employment status and risk of all-cause and cause-specific mortality [29] temporarily unemployed or never employed participants aged 18-65 years had a significantly increased risk of mortality from cancer, cardiovascular disease, chronic lower respiratory disease, diabetes and kidney disease [29] (temporary unemployed HR 1.76, 95% CI 1.67 to 1.86; never employed HR 1.63, 95% CI 1.47 to 1.81; retired HR 1.27, 95% CI 1.17 to 1.37).

Being widowed was significantly associated with high ASCVD risk in our study. Marital status has a protective effect on CVD, especially in men as they benefit from spousal support [29]. In a systematic review and meta-analysis on marital status and risk of cardiovascular diseases showed that partner loss or poor-quality relationships negatively impact on economic, behavioral and emotional well- being of an individual which reduces one's ability to prevent, detect and treat illness. [30] pooled 34 prospective cohort studies which differed from our study in terms of design, a number of participants, and a follow-up component nevertheless, we were able to show the association between ASCVD risk and being widowed.

Strengths of the Study

The strength of the study is that the study was done in a real-world setting with a fairly homogenous population.

Limitations of the Study

The risk calculator we used is not diabetes-specific so we could have overestimated the risk. Additionally, the risk calculator has not been validated in the Ugandan population. This being a cross-sectional study, no causal relationships can be inferred.

Conclusion

Participants in this study were at varied risk for atherosclerotic cardiovascular disease. The male gender, age, ≥50years, part-time employment, and being widowed are significant socio-demographic determinants of the ASCVD risk. Patients with diabetes should have their risk-stratified for appropriate resource allocation in primary prevention.

Acknowledgments

The authors are grateful to Professor Moffat of Medical Research Council Uganda, Mengo Hospital, Star Pharmaceuticals, and Wide spectrum for funding the study. We are also grateful to the study coordinator, study nurses, study participants, and medical superintendents of the study health facilities.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Contributions

WL, SB, RW, and DK, conceptualized and designed the manuscript and revised and approved its final version. WL was the Principal Investigator of this study. RW developed the statistical plan for the study. RM and ES analyzed data with the guidance of WL. SB was the supervisor of the study. All the authors revised and approved the final version.

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Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.08.02.Art008

The Role of Top Management in Developing Security and Safety Culture in the Organization (A Case of Enterprise Group)

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Abstract

The study investigated the role top management play in developing security and safety culture in the organization. Specifically, a case study exploration was used to evaluate one primary area of interest: 1. the role top management plays in developing organization's security and safety culture. The strategy used for this work was exploratory, with both qualitative and quantitative approaches since the data collected would be converted into numerical value for better interpretation. The target population was the staff of Enterprise Group in the Greater Accra Region of Ghana, and the sample was composed of 30 management and staff members, using convenience sampling. Primary and secondary sources of data were used in this study. A survey questionnaire was used to acquire information from the target management and staff of Enterprise Group Ltd. The data gathered was analyzed quantitatively by using descriptive statistical tables and percentages where the Chi-Square test was considered. Statistical package for social sciences (SPSS) version 25 software was also used in the analysis. The study concluded that top management plays a role in developing security and safety culture in organizations through Security and Safety Supervision Committee, by building enabling security and safety working environment in organizations, ensuring there are policies and procedures guidelines in place in organizations. When there is Daily Reporting and available systems to address non-compliance issues in the organization to develop security and safety culture among employees. it is recommended that the Government and regulatory bodies of organizations should emphasize the establishment of security and safety policies in organizations.

Keywords*: Culture, Developing, Security and Safety, Top Management.*

Introduction

Ghana is gradually becoming an industrialized nation, and this change exposes a large percentage of the workforce to various security and safety threats at the workplace. The Labour Department of Ghana Annual report (2000) gave a total of 8,692 work-related accidents reported to the department for compensation claims, while the 1999 figure stood at 4,088 [1]. These figures represented only those occurrences in the formal sector that were reported. The preamble of the International Labour Organization (ILO) constitution highlights that the protection of the worker against sickness, diseases, and injury arising out of employment is a fundamental element of social justice. Occupational safety and health are human rights, and decent work eventually is safe work [2].

A strong security and safety culture is a mentality and a way of working [3]. On the other hand, an integrated process of thinking and decision making can make security and safety systems impenetrable [4]. On the contrary, however the absence of security and safety culture will facilitate uncertainty and, ultimately, will lead to breaches and incidents that are unlikely to predict [5]. Security and safety

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challenges are linked directly to people and management processes within an organizational setup.

In the General Safety Requirements on Leadership and Management for Safety (GSR Part 2), the IAEA establishes requirements that support Principle 3 of the Basic Safety Principles, which focuses on leadership and management of safety [6]. In their publication, Principle 3 states that leadership and management for safety, as well as an effective management system, are established continuously, sustained and improved [6]. They further claim that this is essential to promote and maintain a strong safety culture in the organization. This study, therefore, aims to investigate the role top management play in developing security and culture in organizations.

Literature Review

Managers at all levels of any organization or facility engaged in activities that can lead to radiation hazards or deliberate actions that may harm people, society, and the environment should provide leadership and management systems that integrate both safety and security [7].

Management systems must also be designed to integrate safety, quality, human and organizational factors [8]. The role of senior management in nuclear technologies and in applications where nuclear or other radioactive materials are used or transferred requires them to ensure that safety, security, and physical protection issues will always receive the attention they deserve as a top priority [6].

Considering their duties, the IAEA requires managers at all levels of the organization to establish safety and security objectives consistent with their organization's policy and demonstrate the commitment to improving safety and security performance [6]. They should also encourage and support all individuals in achieving safety and security goals and ensure that their actions encourage continuous learning and improvement among their employees. In addition, senior management needs to seek to correct conditions or actions that are contrary to safety and security.

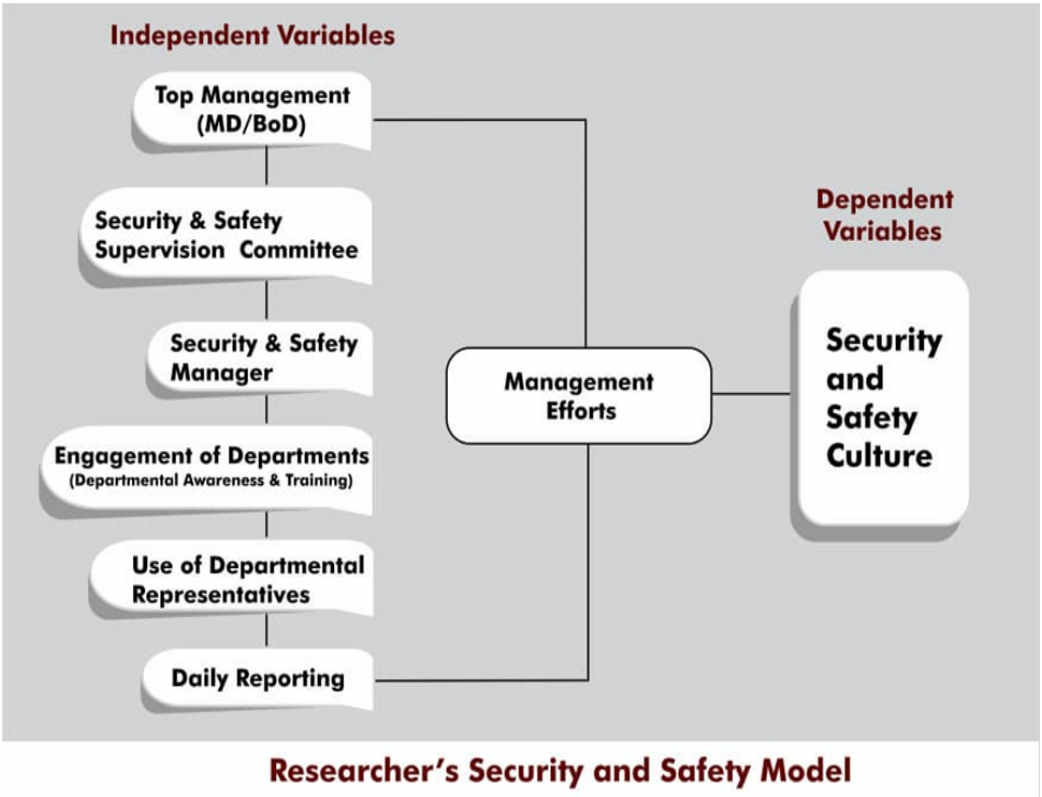

Figure 1. Conceptual Frame Work

Ultimately, senior management is responsible for ensuring that individuals are qualified to carry out their tasks and are aware of the importance and importance of their activities to achieve their organization's safety and security objectives [9].

The IAEA provides the Member States with tools and training to improve and strengthen their leadership and safety and security management. This includes an annual workshop for senior managers and executives on leadership and culture for safety, workshops for middle managers on a systematic approach to safety, and several dedicated tasks to support leadership and management in the Member States [6]. The investigative framework for this research is illustrated in Figure 1.

Top Management (MD/BOD)

For security to be effective, the authority must come from the board of directors, or the Managing Director. In other words, security must report directly to the top management of the organization.

The top management's role in developing and creating security and safety culture across the organizations are discussed as follows:

Education

Knowledge is power; giving the right education and information forms a crucial part of the security and safety culture in every organization. Cybercrime education coupled with a simulation of typical attack scenarios form essential part the security awareness training program in information security. Security must be strengthened and nurtured [10]. Therefore, the spirit of training should follow the top-down approach. Management should lead the advocacy, take a central stage in the development as well as implementation of security and safety policies. Security and safety education should be extended to everyone who can be a threat to the organization. This includes all employees, contractors, entrepreneurs, consultants, third parties (such as suppliers) and even customers [11].

Build Security and Safety Community/ Policy

Security and safety are everyone's problem, and either of us can become the weakest link in an organization's cybersecurity defenses; the finger that clicks on the malware package, the one who reveals his password as a legitimate site. A holistic view must be taken where everyone recognizes the role they play in corporate culture and the impact that they can have personally on security [12]. Understanding security issues throughout the organization, from a clean office policy to developers, understanding the importance of securing security and encryption records must be paramount.

Security Boot Camp

Security awareness training and simulation exercises provide the first-hand experience necessary to learn and understand where the risks lie. A safety training camp can be created that uses a combination of formal classroom-based training with realistic simulation exercises that train people to detect security problems [13]. Security camps should cover all aspects of security and safety within the organization [14]. Simulations, therefore, should be performed regularly but also randomly to create more natural scenarios. Knowing the fact that people are the greatest asset, but on the other hand, they can also be the greatest weakness.

Motivation

Training on security awareness and the culture it instils are measurable and include tests and other measurement activities, make them fun and give rewards for doing a good job [15]. Create a system that rewards and promotes safety best practices. On the contrary, poor results are not used by the individual as punishment, so instead, focus on how to improve

the program; after all, we are all different, and different learning styles fit different types of people [16].

Security Mindfulness

Employees should feel empowered after receiving training and knowledge to help play their roles in preventing a security breach [17]. A culture of safety is a state of mind, and if done correctly, it can become part of the lifestyle of an organization, along with general everyday work [18]. However, we must always remember that a culture of security is part of an ongoing process. Cybercriminals rarely sit on their laurels and develop new and more sophisticated technologies to deceive us [12]. All elements of a culture of security and safety need to be part of an ongoing process, and training should be regular, considering the blindside to simulate phishing [12]. Becoming mindful of security will make the security work normalized.

Security and Safety Supervision Committee

There should be a security oversight committee that manages and directs all security-related issues. They further argue that the committee must have commitments defined by the organization, which will be discussed below [19].

All departments should provide a forum to discuss security, health, and safety issues. The organization expects all key chairmen to assist in the establishment of a security and safety advisory committee in divisions, and the forum should provide input from all levels of the employee [19].

Security and Safety Manager

The third level in the management structure is the security manager who, is directly in charge of all security operations [20]. This structure will also serve as a reporting system from the grassroots to the top, which will enable the organization to build a robust security management system and security Matrix for management decision-making. This structure, therefore, will ensure that a systemic culture is built within the organization to support the security and safety infrastructure.

Engagement of Departments

Security awareness training should be simple and not overly technical [21]. The training itself should be accessible and complete, and employees must have working time during working hours to complete the training so that web-based training is often very effective, especially if there is a meeting to act as a "kick-off" and test when the training is completed.

Use of Departmental Representatives

Research into adoption and changing culture in business has proven to be more successful when there is top-down leadership [22]. This will ensure that the employees understand the importance of creating and maintaining a culture of safety awareness [21]. Departmental representatives can achieve this through frequent staff communication [23]. Taking advantage of opportunities at staff meetings, and communications regularly helps to reinforce the importance that management attaches to security awareness [21].

Daily Reporting Requirements

Regularly communicate updates and reminders of policies and procedures to staff through emails, staff meetings and other communication methods [23].

Periodically assess risks and the level of internal control required to protect the organization 's assets and records related to those risks [24]. Document the process for review, including when it will take place: for example, determine that all security activities, reconciliation processes, and separation of duties must be reviewed annually and reported [25]. They should, however, be staggered. Security activities must be reviewed daily and reported; reconciliation and separation of duties is also key [25]. Management is responsible for ensuring that all staff is familiar with the

organization's internal policies and changes in those policies [26].

Methodology

Specifically, a case study exploration was used to evaluate one primary area of interest: 1. the role top management play in developing security and safety culture in the organization. The strategy used for this work was exploratory, with both qualitative and quantitative approaches since the data collected would be converted into numerical value for better interpretation. The target population was the staff of Enterprise Group in the Greater Accra Region of Ghana using convenience sampling. The sample was composed of 30 management and staff of Enterprise Group Ltd, using convenience sampling. Both primary and secondary sources of data were used in this study. A survey questionnaire was used to acquire information from the target management and staff of Enterprise Group Ltd. The data gathered was analyzed quantitatively by using descriptive statistical tables and percentages where cross tabulation and Chi-Square Test were considered. Statistical package for social sciences (SPSS) version 25 software was also used in the analysis.

Findings

Table 1. Gender of Respondent

Gender of Respondent					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Male	24	80	80	80
	Female	6	20	20	100
	Total	30	100	100	

From Table 1, the total respondents were 30. 24 out of the total respondents were males representing 80% respondents' rate. The remaining 6 respondents were females representing 20% respond rate. This therefore means that majority of the respondents were males.

The researcher also wanted to know the age of respondents and this is represented in Table 2.

Table 2. Age of Respondent

Age of Respondent					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	20 to 29	7	23	23	23
	30 to 39	12	40	40	63
	Over 40	11	37	37	100
	Total	30	100	100	

From Table 2, 7 respondents were between the ages of 20 to 29, representing 23% respondents response rate. 12 of the respondents were also between the ages of 30 to 39 representing 40% responds rate. The remaining 11 respondents were between the ages of 40 above, representing 37% respond rate.

This, therefore, indicates that majority of the respondents were between the ages of 30 to 39.

The researcher went further to determine the level of education of respondents, which is represented in Table 3.

Table 3. Level of Education

Highest Level of Education					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	College Education	3	10	10	10
	University Education	27	90	90	100
	Total	30	100	100	

From Table 3 of the respondents claims, they have a college education and this represents 10% responds rate. The remaining 27 respondents claim they have a university education representing 90% response rate.

This, therefore, indicates the majority of the respondents have a university education.

The researcher wanted to know if respondents have sufficient knowledge in security and safety management, which is represented in Table 4.

Table 4. Knowledge in Security and Safety Management

Sufficient Knowledge in Security and Safety					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Yes	17	57	57	57
	No	13	43	43	100
	Total	30	100	100	

From Table 4, 17 respondents claim they have knowledge in security and safety management, representing 57% respond rate. The remaining 13 respondents claim they do not have sufficient experience in the field of security and safety management representing 43% respond rate. Therefore, this indicates that the majority of the respondents have sufficient knowledge in the field of security and safety management.

The researcher again went further to find out if respondents have work experience in the field of security and safety management. This is represented in Table 5.

Table 5. Work Experience

Work Experience in the Field of Security and Safety					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Yes	13	43	43	43
	No	17	57	57	100
	Total	30	100	100	

From the Table 5, 13 of the respondents claim they have work experience in the field of security and safety management representing 43% respond rate. The remaining 17 respondents claim they do not have work experience in the field of security and safety representing 57% respond rate. Therefore, this indicates that the majority of the respondents do not have work experience in the field of security and safety management.

The researcher wanted to know how many years of experience the respondents who said yes have. This is represented in Table 6.

Table 6. Number of Years of Experience

If Yes How Many Years of Experience					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	1 to 3 years	18	60	60	60
	4 to 10 years	5	7	7	67
	10 years above	7	33	33	100
	Total	30	100	100	

From Table 6, 18 of the respondents claim they have 1 to 3 years' experience in the field of security and safety management, representing 60% respond rate. 5 of the respondents also claim they have 4 to 10 years' experience representing 7% respond rate. The remaining 15 respondents claim that they have 10 years and above experience in the field of security and safety management, representing 33% responds rate. Therefore, this shows that the majority of respondents who said they have work experience in the field of security and safety management, have 1 to 3 years and above experience in the field of security and safety management.

Security and Safety Culture

Table 7. Descriptive Statistics

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
There policies and procedures guidelines put in place in organization	30	1.00	2.00	1.1667	.37905
My organization employs the right people for the right job	30	1.00	2.00	1.1333	.34575
There are available systems to address non-compliance issues in the organization	30	1.00	3.00	1.3000	.53498
There is awareness creation on security and safety issues by management	30	1.00	2.00	1.5000	.50855
I receive regular education on developing security and safety culture in my organization	30	1.00	5.00	2.9667	1.24522
Valid N (listwise)	30				

From Table 7, standard deviation measures how concentrated the data are around the mean. The more concentrated, the smaller the standard deviation. Therefore, the standard deviation is affected by outliers (extremely low or high numbers in the data set). That's because the standard deviation is based on the distance from the mean. This, therefore, means that a small standard deviation stands for data set that are close to the mean of the data set, on average, and a large standard deviation means that the values in the data set are farther away from the mean, on average.

From the findings in Table 7, the respondents indicated policies and procedures guidelines put in place an organization as a form of security and safety culture. This is to a great extent, as indicated by a mean of 1.166 and standard deviation of .379. A Standard deviation of .379 is far away from the mean of 1.166 on average. Therefore, this indicate that there are no policies and procedures guidelines put in place in

respondent's organization that creates a security and safety culture.

From the findings in Table 7, the respondents indicated that organizations employ the right people for the right job. This is to a great extent, as indicated by a mean of 1.133 and standard deviation of .346. A Standard deviation of .346 is far away from the mean of 1.133 on average. Therefore, this indicate that the organization do not employ the right people for the right job in the organization as part of their security and safety culture.

From the findings in Table 7, the respondents indicated that there are available systems to address non-compliance issues in the organization. This is to a great extent, as indicated by a mean of 1.300 and standard deviation of .535. A Standard deviation of .535 is closed to the mean of 1.300 on average. This, therefore, indicate that there are available systems to address non-compliance issues in the organization that creates a security and safety culture.

From the findings in Table 7, the respondents indicated that there is awareness creation on security and safety issues by management. This is to a great extent, as indicated by a mean of 1.5000 and standard deviation of .50855. A Standard deviation of .50855 is closed to the mean of 1.5000 on average. Therefore, this indicate that there is awareness creation on security and safety issues by management as that support the creation of security and safety culture.

From the findings in Table 7, the respondents indicated that respondents receive regular education on developing security and safety culture in my organization. This is to a great extent, as indicated by a mean of 2.9667 and standard deviation of 1.24522. A Standard deviation of 1.24522 is closed to the mean of 2.9667 on average. Therefore, this indicate that respondents receive regular education on developing security and safety culture in my organization as part of the security and safety culture.

Top Management's Role in Developing Security and Safety Culture in the Organization

The researcher wanted to know the role top management plays in developing security and safety culture in respondents' organizations. The researcher, therefore, compared certain factors to the key security and safety culture in respondents' organizations as indicated in the tables below.

A Chi-Square test was considered to test the probability of a significant random distribution. According to this distribution, the significant level is 0.05. this also implies that the value p is 0.05; anything below this p value is considered a very low probability, while anything above is considered a reasonable possibility.

Table 8. Top Management (Md/Bod) (Security is Effective at the Top Management Level and the Authority Comes from the Board of Directors or the Managing Director) * There Policies and Procedures Guidelines Put in Place in Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	6.900a	3	.075
Likelihood Ratio	8.810	3	.032
Linear-by-Linear Association	5.614	1	.018
N of Valid Cases	30		

a. 4 cells (50.0%) have an expected count less than 5. The minimum expected count is 1.00

The researcher wanted to find out whether top management (MD/BOD) ensure there are policies and procedures guidelines put in place in organizations as a form of developing security

and safety culture among employees in developing security and safety management. This is shown in Table 8.

From Table 8, respondents indicated that top management (MD/BOD) does not ensure there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees in developing security and safety management. This can be seen in the Chi-Square test indicating a significance level of 0.075. The significance value is above 0.05, i.e., "p" is greater than .05. This shows that there is no statistically significant difference in the degree of freedom of top management (MD/BOD) and policies and procedures guidelines put in place in respondent's organization in developing security and safety culture in organizations.

The researcher wanted to find out whether top management (MD/BOD) ensure there are available systems to address Non-compliance issues in organizations to develop security and safety culture among employees in the organization. This is shown in Table 9.

Table 9. Top Management (Md/Bod) (Security is Effective at the Top Management Level and the Authority Comes from the Board of Directors or the Managing Director) * There are available Systems to Address Non-Compliance Issues in the Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	4.576a	6	.599
Likelihood Ratio	4.148	6	.657
Linear-by-Linear Association	.023	1	.879
N of Valid Cases	30		

a. 9 cells (75.0%) have an expected count less than 5. The minimum expected count is .20

From Table 9, respondents indicated that top management (MD/BOD) do not ensure there are available systems to address Non-compliance issues in organizations as a form of developing security and safety culture among employees in the organization. This can be seen in the Chi-Square test indicating a significance level of 0.599. The significance value is above 0.05, i.e., "p" is greater than .05. This shows that there is no statistically significant difference in the degree of freedom of top management (MD/BOD) and available systems to address non-compliance in organizations as a form of developing security and safety culture in organizations.

The researcher wanted to determine whether top management (MD/BOD) ensures enabling the organization's security and safety working environment. This is shown in Table 10.

Table 10. Top Management (Md/Bod) (Security is Effective at the Top Management Level and the Authority Comes from the Board of Directors or the Managing Director) * My Top Management Built Enabling Security and Safety Working Environment in my Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	18.557a	9	.029
Likelihood Ratio	20.250	9	.016
Linear-by-Linear Association	6.780	1	.009
N of Valid Cases	30		

a. 16 cells (100.0%) have an expected count less than 5. The minimum expected count is 1.00

From Table 10, respondents indicated that top management (MD/BOD) ensure enabling security and safe working environment in the organization in developing security and safety culture. This can be seen in the Chi-Square test indicating a significance level of 0.029. The significance value is below 0.05, i.e., "p" is less than .05. This shows that there is statistically significant difference in the degree of freedom of top management (MD/BOD) and ensuring enabling security and safe working environment in organizations as a form of developing security and safety culture in organizations.

The researcher wanted to find out whether Security and Safety Supervision Committee (there is a security oversight committee in my organization that manages and directs all security-related issues) ensures there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees in organizations. This is shown in Table 11.

Table 11. Security and Safety Supervision Committee (There is a Security Oversight Committee in my Organization that Manages and Directs all Security-Related Issues). * There Policies and Procedures Guidelines Put in Place in Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	12.000a	4	.017
Likelihood Ratio	13.171	4	.010
Linear-by-Linear Association	9.212	1	.002
N of Valid Cases	30		

a. 7 cells (70.0%) have an expected count less than 5. The minimum expected count is .50

From Table 11, respondents indicated that Security and Safety Supervision Committee (there is a security oversight committee in my organization that manages and directs all security-related issues) ensures there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees in organizations. This can be seen in the Chi-Square test indicating a significance level of 0.017. The significance value is above 0.05, i.e., "p" is greater than .05. This shows that there is no statistically significant difference in the degree of freedom of the Security and Safety Supervision Committee (there is a security oversight committee in my organization that manages and directs all security-related issues) and ensuring there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees in organizations.

The researcher wanted to find out whether top management (MD/BOD) ensure there are available systems to address Non-compliance issues in organizations to develop security and safety culture among employees in the organization. This is shown in Table 12.

Table 12. Security and Safety Supervision Committee (There is a Security Oversight Committee in my Organization that Manages and Directs all Security-Related Issues). * There are Available Systems to Address Non-Compliance Issues in the Organization

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	10.690a	8	.220
Likelihood Ratio	10.351	8	.241
Linear-by-Linear Association	.386	1	.534
N of Valid Cases	30		

a. 13 cells (86.7%) have an expected count less than 5. The minimum expected count is .10.

From Table 12, respondents indicated that Security and Safety Supervision Committee (there is a security oversight committee in my organization that manages and directs all security-related issues). do not ensure there are available systems to address Non-compliance issues in organizations as a form of developing security and safety culture among employees in the organization. This can be seen in the Chi-Square test indicating a significance level of 0.220. The significance value is above 0.05, i.e., "p" is greater than .05. This shows that there is no statistically significant difference in the degree of freedom of the Security and Safety Supervision Committee (there is a security oversight committee in my organization that manages and directs all security-related issues) and available systems to address non-compliance in organizations as a form of developing security and safety culture in organizations.

The researcher wanted to find out whether Security and Safety Supervision Committee (there is a security oversight committee in my organization that manages and directs all security-related issues) ensures enabling security and safety working environment in the organization to develop security and safety culture in organizations. This is shown in Table 13.

Table 13. Security and Safety Supervision Committee (there is a Security Oversight Committee in my Organization that Manages and Directs all Security-Related Issues). * My Top Management Built Enabling Security and Safety Working Environment in my Organization.

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	26.439a	12	.009
Likelihood Ratio	27.177	12	.007
Linear-by-Linear Association	4.259	1	.039
N of Valid Cases	30		

a. 20 cells (100.0%) have an expected count less than 5. The minimum expected count is .50

From Table 13, respondents indicated that Security and Safety Supervision Committee (there is a security oversight committee in my organization that manages and directs all security-related issues) ensure enabling security and safety working environment in the organization in developing security and safety culture. This can be seen in the Chi-Square test indicating a significance level of 0.009. The significance value is below 0.05. i.e., "p" is less than .05. This shows that there is a statistically significant difference in the degree of freedom of the Security and Safety Supervision Committee (there is a security oversight committee in my organization that manages and directs all security-related issues) and enabling security and safety working environment in organizations as a form of developing security and safety culture in organizations.

The researcher wanted to find out whether Security and Safety Manager (My security and safety manager ensures a reporting system from the grassroots to the top which enables the organization to build a robust security management system and security Matrix for management decision-making") ensures there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees in organizations. This is shown in Table 14.

Table 14. Security and Safety Manager (My Security and Safety Manager Ensure a Reporting System from the Grassroots to the Top which Enables the Organization to build a Robust Security Management System and Security Matrix for Management Decision-Making") * There Policies and Procedures Guidelines Put in Place in Organization

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	9.300a	4	.054
Likelihood Ratio	10.903	4	.028
Linear-by-Linear Association	6.700	1	.010
N of Valid Cases	30		

a. 7 cells (70.0%) have an expected count less than 5. The minimum expected count is .67

From Table 14, respondents indicated that Security and Safety Manager (My security and safety manager ensure a reporting system from the grassroots to the top which enables the organization to build a robust security management system and security Matrix for management decision-making") ensures there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees in organizations. This can be seen in the Chi-Square test indicating a significance level of 0.054. The significance value is = 0.05. i.e., "p" is equal to .05. This shows that there is a statistically significant difference in the degree of freedom of the Security and Safety Manager (My security and safety manager ensure a reporting system from the grassroots to the top, which enables the organization to build a robust security management system and security Matrix for management decision-making") and ensuring there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees in organizations.

The researcher wanted to find out whether Security and Safety Manager (My security and safety manager ensure a reporting system from the grassroots to the top which enables the organization to build a robust security management system and security Matrix for management decision-making") ensure there are available systems to address Non-compliance issues in organizations as a form of developing security and safety culture among employees in the organization. This is shown in Table 15.

Table 15: Security and Safety Manager (My Security and Safety Manager Ensure a Reporting System from the Grassroots to the Top which enables the Organization to build a Robust Security Management System and Security Matrix for Management Decision-Making") * There are Available Systems to Address Non-Compliance Issues in the Organization

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	12.544a	8	.129
Likelihood Ratio	11.175	8	.192
Linear-by-Linear Association	3.612	1	.057
N of Valid Cases	30		

a. 12 cells (80.0%) have an expected count less than 5. The minimum expected count is .13

From the Table 15, respondents indicated that Security and Safety Manager (My security and safety manager ensure a reporting system from the grassroots to the top which enables the organization to build a robust security management system and security Matrix for

management decision-making") do not ensure there are available systems to address non-compliance issues in the organization. This can be seen in the Chi-Square test indicating a significance level of 0.129. The significance value is above 0.05, i.e., "p" is greater than .05. This shows that there is no statistically significant difference in the degree of freedom of Security and Safety Manager (My security and safety manager ensure a reporting system from the grassroots to the top which enables the organization to build a robust security management system and security Matrix for management decision-making") and ensure there are available systems to address non-compliance issues in the organization as a form of developing security and safety culture in organizations.

The researcher wanted to find out whether Security and Safety Manager (My security and safety manager ensures a reporting system from the grassroots to the top which enables the organization to build a robust security management system and security Matrix for management decision-making") ensures top management built enabling security and safety working environment in the organization as a form of developing security and safety culture among employees in organizations. This is shown in Table 16.

Table 16. Security and Safety Manager (My Security and Safety Manager ensure a Reporting System from the Grassroots to the Top which Enables the Organization to build a Robust Security Management System and Security Matrix for Management Decision-Making") * My Top Management Built Enabling Security and Safety Working Environment in my Organization

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	24.056a	12	.020
Likelihood Ratio	24.066	12	.020
Linear-by-Linear Association	6.553	1	.010
N of Valid Cases	30		

a. 20 cells (100.0%) have an expected count less than 5. The minimum expected count is .67

From Table 16, respondents indicated that Security and Safety Manager (My security and safety manager ensure a reporting system from the grassroots to the top which enables the organization to build a robust security management system and security Matrix for management decision-making") ensures top management built enabling security and safety working environment in the organization as a form of developing security and safety culture among employees in organizations. This can be seen in the Chi-Square test indicating a significance level of 0.020. The significance value is below 0.05, i.e., "p" is less than .05. This shows that there is a statistically significant difference in the degree of freedom of Security and Safety Manager (My security and safety manager ensures a reporting system from the grassroots to the top, which enables the organization to build a robust security management system and security Matrix for management decision-making") and top management building enabling security and safe working environment in the organization as a form of developing security and safety culture among employees in organizations.

The researcher wanted to find out whether the Engagement of Departments (my management ensures departmental awareness and training on security and safety policies) ensures there are policies and procedures guidelines put in place in organizations as a form of developing a security and safety culture among employees in organizations. This is shown in Table 17.

Table 17. Engagement of Departments (My Management Ensures Departmental Awareness and Training on Security and Safety Policies) * There Policies and Procedures Guidelines Put in Place in Organization

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	6.857a	4	.144
Likelihood Ratio	7.233	4	.124
Linear-by-Linear Association	5.000	1	.025
N of Valid Cases	30		

a. 6 cells (60.0%) have an expected count less than 5. The minimum expected count is .50

From the Table 17, respondents indicated that Engagement of Departments (my management ensures departmental awareness and training on security and safety policies) do not ensure there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees in organizations. This can be seen in the Chi-Square test indicating a significance level of 0.144. The significance value is above 0.05`, i.e., "p" is greater .05. This shows that there is no statistically significant difference in the degree of freedom of Engagement of Departments (my management ensures departmental awareness and training on security and safety policies) and ensuring there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees.

The researcher wanted to find out whether Engagement of Departments (my management ensures departmental awareness and training on security and safety policies) ensures there are available systems to address non-compliance to develop security and safety culture among employees in organizations. This is shown in Table 18.

Table 18. Engagement of Departments (My Management ensures Departmental Awareness and Training on Security and Safety Policies) * There are Available Systems to Address Non-Compliance Issues in the Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	7.681a	8	.465
Likelihood Ratio	8.657	8	.372
Linear-by-Linear Association	1.647	1	.199
N of Valid Cases	30		

a. 12 cells (80.0%) have an expected count less than 5. The minimum expected count is .10

From Table 18, respondents indicated that Engagement of Departments (my management ensures departmental awareness and training on security and safety policies) do not ensure there are available systems to address non-compliance issues in organizations as a form of developing security and safety culture among employees in organizations. This can be seen in the Chi-Square test indicating a significance level of 0.465. The significance value is above 0.05, i.e., "p" is greater .05. This shows that there is no statistically significant difference in the degree of freedom of Engagement of Departments (my management ensures departmental awareness and training on security and safety policies) and ensuring there are available systems to address non-compliance issues in organizations as a form of developing security and safety culture among employees in organizations.

The researcher wanted to find out whether Use of Departmental Representatives (There is top-down leadership and frequent communication to staff in my organization on security and safety matters) ensures there are policies in and procedures guidelines put in place the organization as a form of developing security and safety culture among employees in organizations. This is shown in Table 19.

Table 19. Use of Departmental Representatives (There Is Top-Down Leadership and Frequent Communication to Staff in My Organization on Security and Safety Matters) * There Policies and Procedures Guidelines Put in Place in Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	4.800a	4	.308
Likelihood Ratio	6.351	4	.174
Linear-by-Linear Association	3.100	1	.078
N of Valid Cases	30		

a. 6 cells (60.0%) have an expected count less than 5. The minimum expected count is .83

From Table 19, respondents indicated that Use of Departmental Representatives (There is top-down leadership and frequent communication to staff in my organization on security and safety matters) do not ensure there are available systems to address non-compliance issues in organizations as a form of developing security and safety culture among employees in organizations. This can be seen in the Chi-Square test indicating a significance level of 0.308. The significance value is above 0.05, i.e., "p" is greater .05. This shows that there is no statistically significant difference in the degree of freedom of Use of Departmental Representatives (There is top-down leadership and frequent communication to staff in my organization on security and safety matters) and available systems to address non-compliance issues in organizations as a form of developing security and safety culture among employees in organizations.

The researcher wanted to find out whether Use of Departmental Representatives (There is top-down leadership and frequent communication to staff in my organization on security and safety matters) ensures there are policies in and procedures guidelines put in place the organization as a form of developing security and safety culture among employees in organizations. This is shown in Table 20.

Table 20. Use of Departmental Representatives (There is Top-Down Leadership and Frequent Communication to Staff in my Organization on Security and Safety Matters) * There are available Systems to Address Non-Compliance Issues in the Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	20.786a	8	.008
Likelihood Ratio	19.599	8	.012
Linear-by-Linear Association	2.383	1	.123
N of Valid Cases	30		

a. 14 cells (93.3%) have an expected count less than 5. The minimum expected count is .17

From Table 20, respondents indicated that Use of Departmental Representatives (There is top-down leadership and frequent communication to staff in my organization on security and safety matters) ensure there are available systems to address non-compliance

issues in organizations as a form of developing security and safety culture among employees in organizations. This can be seen in the Chi-Square test indicating a significance level of 0.008. The significance value is below 0.05, i.e., "p" is less .05. This shows that there is statistically significant difference in the degree of freedom of Use of Departmental Representatives (There is top-down leadership and frequent communication to staff in my organization on security and safety matters) and available systems to address non-compliance issues in organizations as a form of developing security and safety culture among employees in organizations.

The researcher wanted to find out whether Daily Reporting (My Management regularly communicate updates and reminders of policies and procedures to staff through emails, staff meetings and other communication methods) ensures there are policies in and procedures guidelines put in place the organization as a form of developing security and safety culture among employees in organizations. This is shown in Table 21.

Table 21. Daily Reporting (My Management Regularly Communicate Updates and Reminders of Policies and Procedures to Staff through Emails, Staff Meetings, and other Communication Methods) * There Policies and Procedures Guidelines Put in Place in Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	3.218a	4	.522
Likelihood Ratio	4.466	4	.347
Linear-by-Linear Association	2.503	1	.114
N of Valid Cases	30		

a. 8 cells (80.0%) have an expected count less than 5. The minimum expected count is .67

From Table 21, respondents indicated that Daily Reporting (My Management regularly communicate updates and reminders of policies and procedures to staff through emails, staff meetings and other communication methods) do not ensure there are policies in and procedures guidelines put in place the organization as a form of developing security and safety culture among employees in organizations. This can be seen in the Chi-Square test indicating a significance level of 0.522. The significance value is above 0.05, i.e., "p" is less .05. This shows that there is no statistically significant difference in the degree of freedom of Daily Reporting (My Management regularly communicate updates and reminders of policies and procedures to staff through emails, staff meetings and other communication methods) and ensuring there are policies in and procedures guidelines put in place the organization as a form of developing security and safety culture among employees in organizations. as a form of developing security and safety culture among employees in organizations.

Table 22: Daily Reporting (My Management Regularly Communicate Updates and Reminders of Policies and Procedures to Staff through Emails, Staff Meetings, and other Communication Methods) * There are Available systems to Address Non-Compliance Issues in the Organization

Chi-Square Tests			
	Value	**Df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	10.328a	8	.243
Likelihood Ratio	9.767	8	.282
Linear-by-Linear Association	1.147	1	.284
N of Valid Cases	30		

a. 14 cells (93.3%) have an expected count less than 5. The minimum expected count is .13

The researcher wanted to find out whether Daily Reporting (My Management regularly communicate updates and reminders of policies and procedures to staff through emails, staff meetings and other communication methods) ensures there are available systems to address non-compliance issues in the organization as a form of developing security and safety culture among employees. This is shown in Table 22.

From Table 22, respondents indicated that Daily Reporting (My Management regularly communicate updates and reminders of policies and procedures to staff through emails, staff meetings and other communication methods) do not ensure there are available systems to address non-compliance issues in the organization as a form of developing security and safety culture among employees. This can be seen in the Chi-Square test indicating a significance level of 0.243. The significance value is above 0.05, i.e., "p" is greater .05. This shows that there is no statistically significant difference in the degree of freedom of Daily Reporting (My Management regularly communicate updates and reminders of policies and procedures to staff through emails, staff meetings and other communication methods) and ensuring there are available systems to address non-compliance issues in the organization as a form of developing security and safety culture among employees.

Results

Managers at all levels of any organization or facility engaged in activities that can lead to radiation hazards or deliberate actions that may harm people, society and the environment should provide leadership and management systems that integrate both safety and security [7]. This confirms the present study that Security and Safety Supervision Committee play a role by building enabling security and safety working environment in organizations as a form of developing security and safety culture in organizations.

The study also concluded that there is Engagement of Departments through ensuring there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees. This confirms [9] study that ultimately, senior management is responsible for ensuring that individuals are qualified to carry out their tasks and are aware of the importance and importance of their activities to achieve the safety and security objectives of their organization. The study also went contrary to [9] by revealing that top management do not ensure there are available systems to address non-compliance issues in organizations as a form of developing security and safety culture among employees in organizations.

Discussion

Managers at all levels of any organization or facility engaged in activities that can lead to radiation hazards or deliberate actions that may harm people, society and the environment should provide leadership and management systems that integrate both safety and security (Sadgrove, 2016). This confirms the present study that, Security and Safety Supervision Committee play a role by building enabling security and safety working environment in organizations as a form of developing security and safety culture in organizations.

The study also revealed that, there is Engagement of Departments through ensuring there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees. This confirms Armstrong, (2006) study that, ultimately, senior management is responsible for ensuring that individuals are qualified to carry out their tasks and are aware of the importance and importance of their activities to achieve the safety and security objectives of their organization. The study also went contrary to Armstrong, (2006) by revealing that, top management do not ensure there are available systems to address non-compliance issues in organizations as a form of developing security

and safety culture among employees in organizations.

The above study is of significance in many ways. First, it will serve as a guide to corporate organizations in developing and creating security and safety culture awareness among employees. Secondly, it will also serve as a reference to future researchers who are interested in researching deep into security and safety culture across organizations. Last but not least, the study will contribute to the body of knowledge in furthering our understanding of the role top management play in developing security and safety culture across organizations.

Conclusion

From the study, it can be concluded that Security and Safety Supervision Committee play a role by building enabling security and safety working environment in organizations as a form of developing security and safety culture in organizations. It is again concluded that Security and Safety Manager play a role by ensuring there are policies and procedures guidelines put in place in organizations, building enabling security and safety working environment in the organization, but do not ensure there are available systems to address non-compliance issues in the organization as a form of developing security and safety culture in organizations.

It is further concluded that there is Engagement of Departments through ensuring there are policies and procedures guidelines put in place in organizations as a form of developing security and safety culture among employees. However, top management do not ensure there are available systems to address non-compliance issues in organizations as a form of developing security and safety culture among employees in organizations.

The study further concluded that top management do not use Departmental Representatives to ensure there are available systems to address non-compliance issues in organizations as a form of developing security and safety culture among employees in organizations.

The study finally concluded that top management play a role through Daily Reporting by ensuring there are policies in and procedures guidelines put in place in the organization and also ensuring there are available systems to address non-compliance issues in the organization as a form of developing security and safety culture among employees.

Recommendations for Practice and Future Research

From this study, it is recommended that management should ensure the formation of security and safety committee, safety managers should be on top of their jobs, engagement of departments, daily reporting from top to down and the use of departmental representatives in establishing security and safety compliance systems and policies and procedures guidelines. The government and regulatory bodies of organizations should emphasize the establishment of security and safety policies in organizations and ensure strict adherence to these police to enhance security and safety effectiveness.

Also, for future researches it is recommended that the study be verified among other organizations in Ghana to ascertain the role top management plays in developing security and safety culture in the organization.

Acknowledgement

I am very grateful to the management and staff of Enterprise Group and S.G. Technologies for their support. Another great thanks go to Prof. Michael Adusei, for his support and selfless guidance that carried us throughout this research project.

Declaration of Conflicting Interests

The authors declares that there is no conflict of interest.

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